SOIL SURVEY OF

Moore County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1965–66. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1966. The survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. The Moore County Commissioners Court and the Dumas Independent School District, through a cooperative agreement with the above-mentioned agencies, contributed funds to help defray the cost of the survey. The survey is part of the technical assistance furnished to the Moore County Soil and Water Conservation District.

Copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Moore County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of the Soils."

Newcomers in Moore County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "Additional Facts about the County."

Cover: **Harvesting winter wheat on Sherm silty clay loam, 0 to 1 percent slopes. City of Etter is in background.**

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SOIL SURVEY OF MOORE COUNTY, TEXAS

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SOILS SURVEYED BY LUTHER C. GEIGER, HEBERT E. BRUNS, EDWARD MERRICK, AND PAUL BODEN, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

MOORE COUNTY is in the north-central part of the Texas Panhandle (fig. 1). It is in the southern part of the Great Plains, which extend from Texas to Canada. About two-thirds of the county is in the nearly level, smooth uplands of the High Plains. The rest is the rolling and broken areas of the Canadian River valley, locally known as the Canadian Breaks. Moore County is bounded on the north by Sherman County, on the east by Hutchinson County; on the south by Potter County, and on the west by Hartley County. It has a total area of 914 square miles, or 584,960 acres.

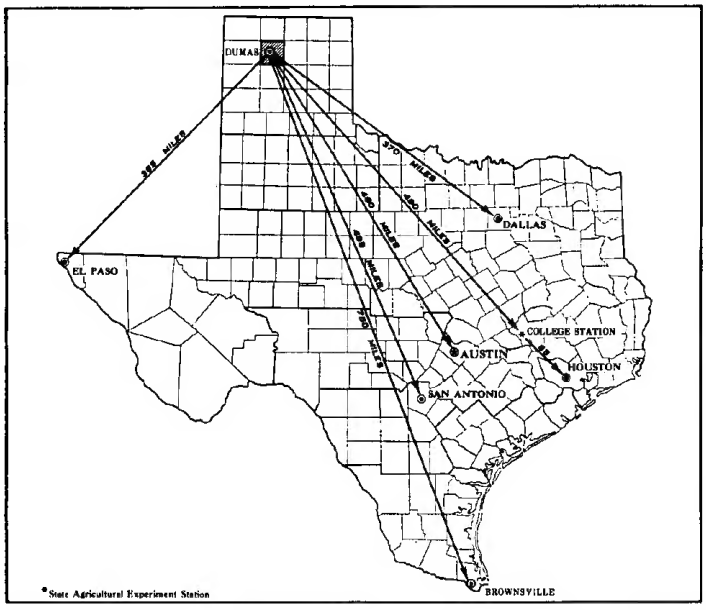

Figure 1.—Location of Moore County in Texas.

Development of Moore County depended greatly on farming and ranching. Also very important was the production of natural gas, helium, and commercial fertilizer.

Forty-two percent of the county is currently cultivated. About three-fifths of this is irrigated from deep wells. The rest is dryfarmed. The major crops, both dryland and irrigated, are winter wheat and grain sorghum. Lesser acreages of soybeans, sorghum for grazing, silage, corn, and vegetables are grown. The rangelands are used to produce beef cattle.

Almost all the cropland in the county, except for a few small fields, is on the smooth expanses of the High Plains. Similarly, almost all of the range is in the Canadian Breaks, except for a few areas that are intermingled with the croplands of the High Plains.

Moore County has a dry, steppe climate. Average annual precipitation is 18.95 inches but ranges from 8 to 27 inches. There are periods of drought in which dryfarmed crops produce little followed by years that are wet enough to produce profitable crops.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Moore County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement in the profile, and other important characteristics. Each series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Dumas and Dalhart for example, are the

names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Dumas loam, 0 to 1 percent slopes, is one of several phases within the Dumas series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, trees and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Moore County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Ulysses-Sunray complex, 3 to 5 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Springer and Likes soils, undulating, is an undifferentiated group in Moore County.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rough broken land is a land type in Moore County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Moore County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Moore County are discussed in the following pages.

The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of association 1, the word "loamy" refers to the texture of the surface layer.

1. Sherm association

Nearly level, deep, noncalcareous, loamy soils

This association occupies most of the tablelands of the High Plains. It is a broad area that is locally known as wheatlands or hardlands. Prominent topographic

features generally are lacking, but there are a few low rises and dish-shaped depressions. These depressions catch most of the runoff, and the rest flows into the few creeks and draws that cut across the plains (fig. 2).

This association covers about 50 percent of the county. Sherm soils make up about 90 percent of the association. The rest is small areas of Conlen, Dalhart, Dumas, Harney, Ness, and Sunray soils.

Sherm soils typically have a grayish-brown silty clay loam surface layer about 6 inches thick. The next layer is about 44 inches thick. In sequence from the top, the upper 13 inches of this layer is dark-brown clay; the next 26 inches is calcareous, brown clay; and the lower 5 inches is reddish-brown clay loam. The underlying material, reaching to a depth of 72 inches, is soft caliche of clay loam texture and is pink in the upper part and reddish yellow in the lower part.

The soils in this association are only slightly susceptible to soil blowing. The hazard of water erosion is slight to moderate. The soils in this association are well drained. Permeability is very slow, and available water capacity is high.

Most of this association is used for crops, both dryland and irrigated. Irrigation is by gravity-flow furrow systems. Farms average about 2,500 acres in size. Most farmers reside in Dumas or Sunray and commute to their farms, but a few live on their farms.

2. *Mobeetie-Tascosa-Pastura association*

Gently sloping to steep, very shallow to deep, calcareous, loamy and gravelly soils

This association occupies most of the Canadian Breaks. Interspersed in the association are draws, streams, and a few broken areas (fig. 3).

This association covers about 26 percent of the county. Mobeetie soils make up about 29 percent of the association, Tascosa soils about 12 percent, and Pastura soils about 12 percent. The remaining 47 percent is minor soils, including Veal, Lincoln, Cass, and Likes soils.

Mobeetie soils occupy the lower parts of the hills and ridges and extend down to the draws and creeks. Typically they have a grayish-brown, calcareous fine sandy loam surface layer about 10 inches thick. The next layer is light brownish-gray, very friable fine sandy loam that reaches to a depth of 20 inches. The underlying material is light-brown fine sandy loam that reaches to a depth of 40 inches.

Tascosa soils are on gravelly ridges and hills throughout this soil association. They ordinarily have a brown

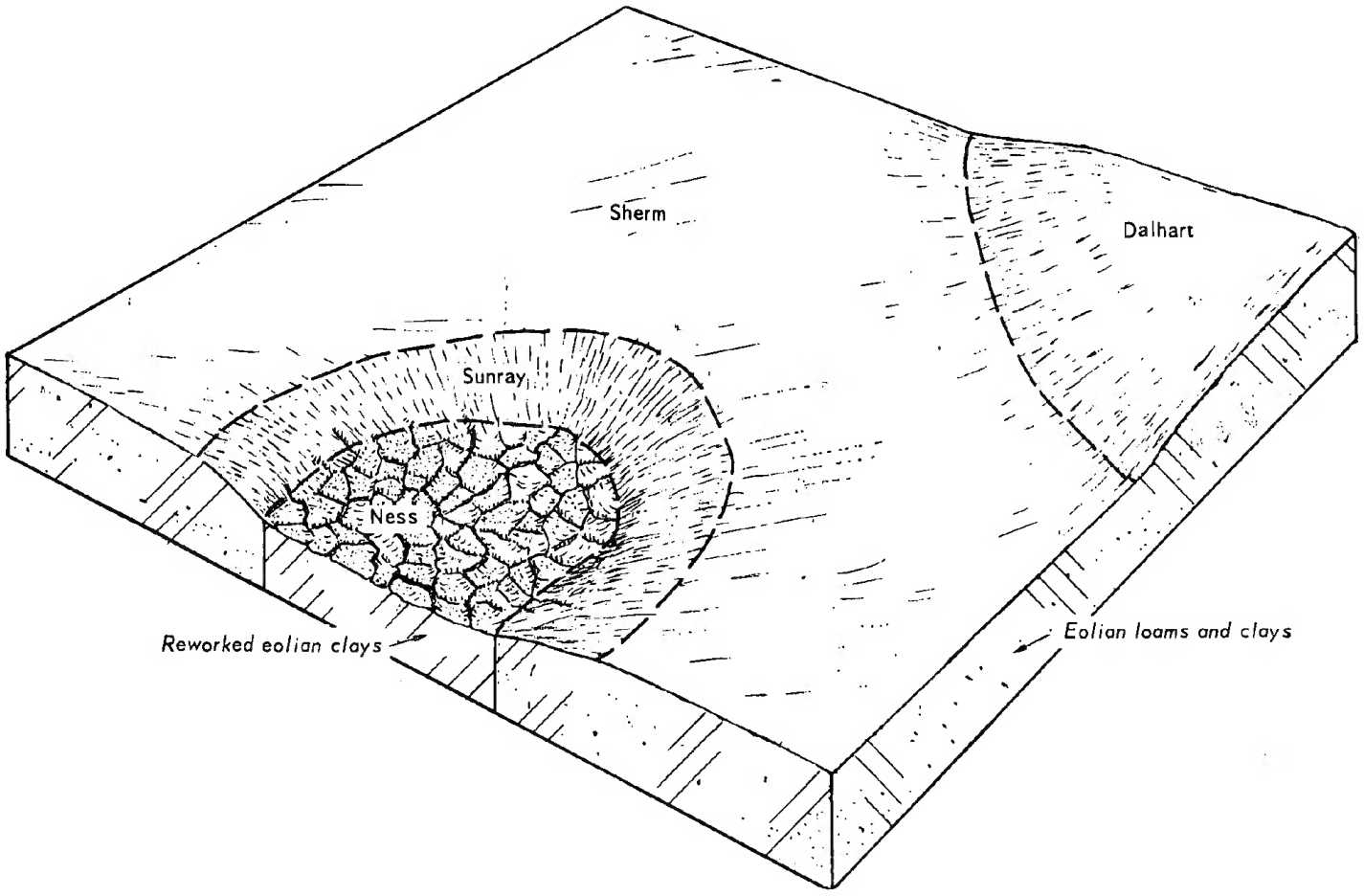

Figure 2.—Typical pattern of soils in the Sherm association.

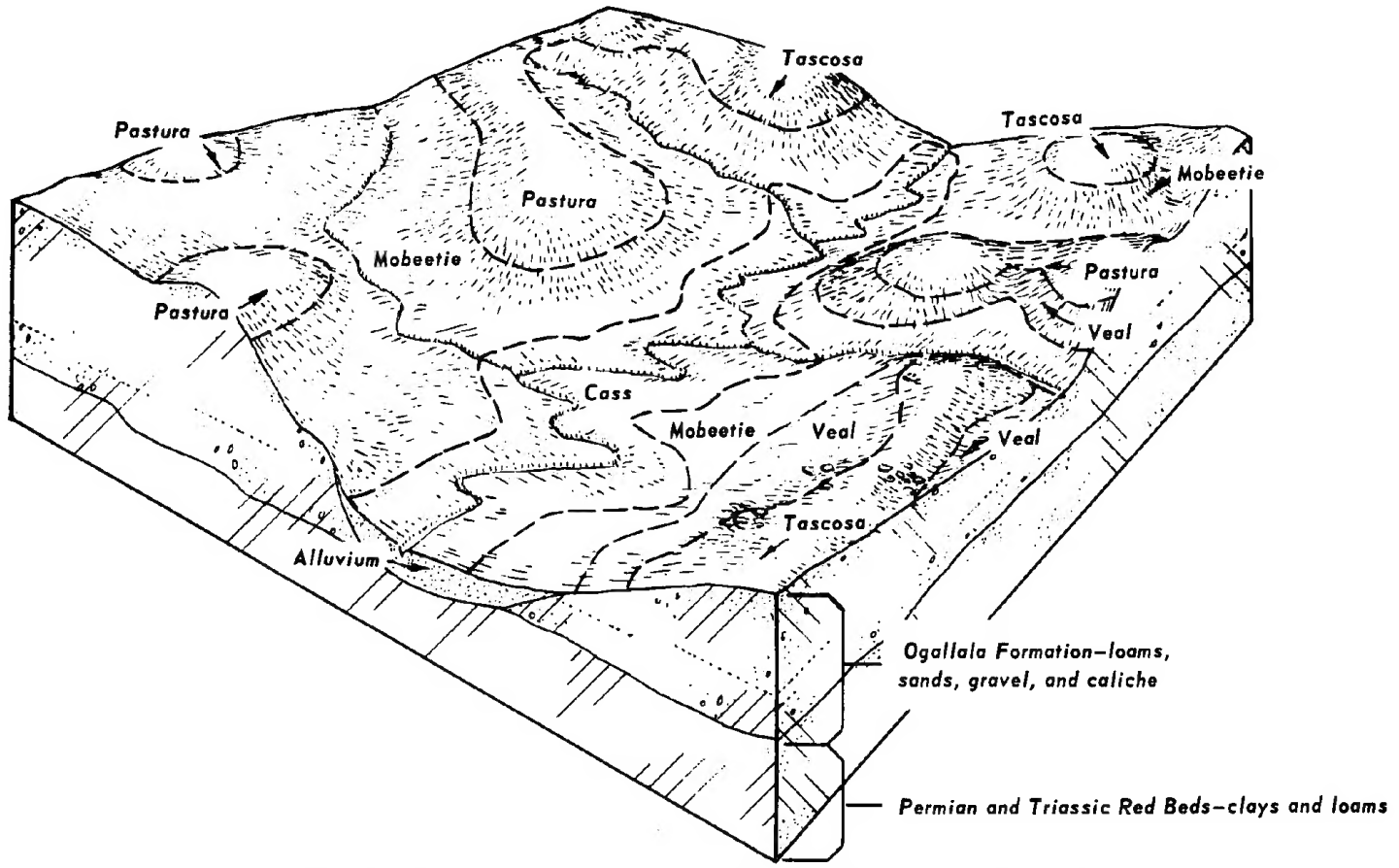

Figure 3.—**Typical pattern of soils in the Mobeetie-Tascosa-Pastura association.**

gravelly loam surface layer about 9 inches thick. The next layer is pinkish-gray very gravelly loam that is 4 inches thick. The underlying material, to a depth of 60 inches, is calcareous, pinkish-gray very gravelly loam in the upper part and pink very gravelly sandy loam in the lower part.

Pastura soils commonly are on the tops of hills and ridges. Typically they have a pale-brown gravelly loam surface layer 8 inches thick. The underlying material is white, loose pebbles of caliche in the upper few inches and grades to weakly cemented caliche with increasing depth.

The soils in this association are moderately permeable to moderately rapidly permeable. The available water capacity is moderate to low. The hazard of soil blowing is slight to moderate. The hazard of water erosion is moderate to severe.

This association is in several large ranches, and almost all of the acreage is used for range.

3. *Sunray association*

Nearly level to gently sloping, deep, calcareous, loamy soils

This association is in smooth, scattered areas on the High Plains. The soils formed in limy, loamy sediments of the High Plain eolian mantle.

This association covers about 7 percent of the county. About 90 percent of the association is Sunray soils. The remaining 10 percent is Conlen, Capps, and other minor soils.

Sunray soils typically have a grayish-brown loam surface layer 12 inches thick. The next layer is brown clay loam 10 inches thick. Below this is pink clay loam 12 inches thick. The underlying material, reaching to a depth of 60 inches, is reddish-yellow clay loam.

The soils in this association are well drained and moderately permeable. Available water capacity is high. The hazard of soil blowing is moderate. The hazard of water erosion is slight to moderate.

This association is used mostly for crops. A few areas are used for range. Farms average about 2,400 acres in size. Most are operated by absentee landowners or are leased to farm operators.

4. *Dumas-Dalhart association*

Nearly level to gently sloping, deep, noncalcareous, loamy soils

This association is mostly in smooth, nearly level areas. Some areas, however, are on low, gentle rises that are several hundred feet wide and up to a mile long and have slopes of ½ to 1½ percent.

This association covers about 6 percent of the county. Dumas soils make up about 60 percent of the association, and Dalhart soils about 30 percent. The remaining 10 percent is Harney, Sunray, and other minor soils.

Dumas soils typically have a neutral, brown loam surface layer 11 inches thick. The next layer is about 26 inches thick. It is brown, neutral, friable clay loam in the upper part, and light-brown, calcareous, moderately alkaline clay loam in the lower part. The underlying material is pink silty clay loam that reaches to a depth of 64 inches.

Dalhart soils typically have a brown fine sandy loam surface layer 9 inches thick. The next layer, about 21 inches thick, is brown, friable sandy clay loam. Below this is brown sandy clay loam caliche about 5 inches thick. The underlying material is reddish-yellow fine sandy loam to a depth of 45 inches.

These soils are well drained and moderately permeable. Available water capacity is high. The hazard of soil blowing is slight to moderate. The hazard of water erosion is slight to severe.

Most of this association is cultivated. Some areas are irrigated, mostly by graded-furrow gravity systems. A few areas are irrigated by sprinkler system. Farms average about 2,500 acres in size. Most landowners live in the towns and commute to their farms, or they have leased their land to farm operators.

5. *Likes-Springer-Tivoli association*

Undulating to hummocky and duned, deep, calcareous and noncalcareous, sandy soils

This association occupies broad areas on upland plains in the Canadian Breaks.

This association covers about 4 percent of the county. Likes soils make up about 50 percent of the association, Springer soils 25 percent, and Tivoli soils 20 percent. The remaining 5 percent is Mobeetie, Veal, and other minor soils.

Likes soils typically are loamy fine sand throughout the profile. The surface layer is brown and about 8 inches thick. The underlying material, to a depth of about 20 inches, is pale brown. Below this, to a depth of 50 inches, it is pinkish gray.

Springer soils typically have a brown, neutral loamy fine sand surface layer about 12 inches thick. The next layer, to a depth of about 30 inches, is brown, neutral fine sandy loam. The underlying material, reaching to a depth of 60 inches, is light-brown fine sandy loam.

Tivoli soils typically have a brown fine sand surface layer about 8 inches thick. The underlying material, reaching to a depth of 60 inches, is light-brown fine sand.

The soils in this association are well drained to excessively drained. Permeability is moderately rapid to rapid. Available water capacity is low to moderate. The hazard of soil blowing is severe.

This association is in three or four large ranches, and most of the acreage is in range.

6. *Sunray-Ulysses-Humbarger association*

Nearly level to sloping, deep, calcareous, loamy soils

This association occupies the bottom lands and adjacent slopes along creeks and draws that cross the High Plains (fig. 4). The bottom lands are occupied by Humbarger soils in areas 150 to 800 feet wide. The slopes are occupied by Sunray and Ulysses soils, which have a convex surface and a gradient of about 5 percent.

This association covers about 4 percent of the county. The Sunray soils make up about 40 percent of the association, Ulysses soils 39 percent, and Humbarger soils 10 percent. The remaining 11 percent is Conlen, Pastura, Manzano, and other minor soils.

Sunray soils typically have a grayish-brown loam surface layer 12 inches thick. The next layer is brown clay loam about 10 inches thick. Below this is pink clay loam 12 inches thick. The underlying material, to a depth of 60 inches, is reddish-yellow clay loam.

Ulysses soils typically have a calcareous, grayish-brown loam surface layer about 11 inches thick. The next layer is light-brown, calcareous clay loam about 9 inches thick. The underlying material, to a depth of 25 inches, is light-brown clay loam that is high in lime. Below this, to a depth of 60 inches, is reddish-yellow clay loam.

Humbarger soils have a grayish-brown, calcareous loam surface layer about 15 inches thick. The next layer is calcareous, brown, friable clay loam about 15 inches thick, The underlying material is faintly stratified, friable, brown clay loam that reaches to a depth of 60 inches.

The soils in this association are well drained. Permeability is moderate, and available water capacity is high. Water erosion is a slight to severe hazard. Soil blowing is a moderate hazard.

On this association are parts of several farms and ranches. Most of the acreage is in range, but a few areas are cultivated.

7. *Rough broken land association*

Escarpments, gullies, canyon walls, and sloping to very steep areas

This association consists mostly of escarpments, jagged bluffs, canyons, foot slopes, and severely gullied areas. The bluffs and canyon walls typically are reddish, nearly vertical, and capped by sandstone, limestone, or chert. The walls and bluffs range from 100 to about 800 feet in height. This association formed in the Permian red beds.

This association borders Lake Meredith and creeks and canyons that drain into the lake. The association covers about 2 percent of the county, and adjoining Lake Meredith covers about 1 percent.

Rough broken land makes up about 85 percent of this association. Small areas of soils intermingled with rough and broken land make up the remaining 15 percent. The soils in the small areas are mainly members of the Enterprise, Vernon, Ector, and Ulysses series, but Veal, Pastura, Mobeetie, and Conlen soils are also present.

Geologic erosion is active in this association. The plant cover in most places is not sufficient to prevent very rapid runoff.

This association is used for range and recreation. Some of the steeper areas are inaccessible to cattle and

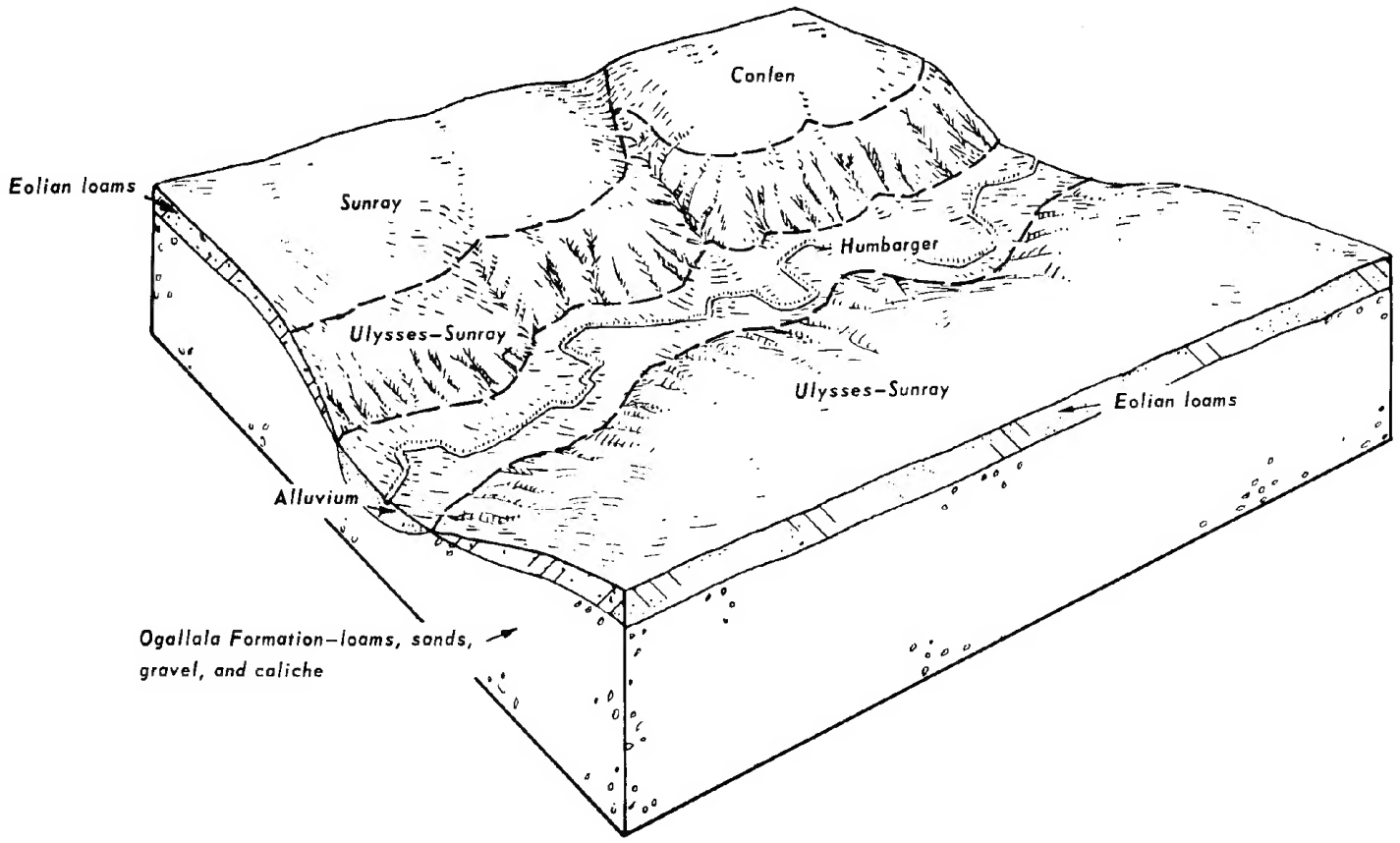

Figure 4.—**Typical pattern of soils in the Sunray-Ulysses-Humbarger association.**

horses. Good management of the adjoining, smoother range sites is necessary to assure proper care of this association.

This association provides refuge for many kinds of wildlife. It is in the National Park Service lands of Lake Meredith and on two or three adjoining ranches.

Descriptions of the Soils

This section describes the soil series and mapping units in Moore County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping unit in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soils unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Rough broken land, for example, does not belong to a soil series, but nevertheless is listed in alphabetic order with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description are the capability unit and range site in which a mapping unit has been placed. The page for the description of each capability unit and range site can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*5*).[1]

[1] Italic numbers in parentheses refer to Literature Cited, p. 54.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Capps clay loam, 0 to 1 percent slopes	3,705	0.6
Capps clay loam, 1 to 3 percent slopes	829	.1
Cass fine sandy loam, calcareous	1,856	.3
Conlen loam, 0 to 1 percent slopes	2,454	.4
Conlen loam, 1 to 3 percent slopes	8,002	1.4
Conlen loam, 3 to 5 percent slopes	3,995	.7
Conlen loam, 5 to 8 percent slopes	1,598	.3
Dalhart fine sandy loam, 0 to 1 percent slopes	3,185	.5
Dalhart fine sandy loam, 1 to 3 percent slopes	6,066	1.0
Dalhart fine sandy loam, 3 to 5 percent slopes	3,239	.6
Dumas loam, 0 to 1 percent slopes	9,040	1.5
Dumas loam, 1 to 3 percent slopes	6,148	1.0
Dumas loam, 3 to 5 percent slopes	6,376	1.1
Dumas and Tascosa soils, rolling	5,842	1.0
Ector-Ulysses complex, hilly	823	.1
Enterprise very fine sandy loam, 5 to 8 percent slopes	4,182	.7
Harney clay loam, 0 to 1 percent slopes	15,375	2.6
Harney clay loam, 1 to 3 percent slopes	3,455	.6
Humbarger loam	2,691	.5
Likes loamy fine sand, hummocky	10,692	1.8
Likes complex, hummocky	3,758	.6
Lincoln loamy fine sand	1,571	.3
Manzano clay loam, 1 to 3 percent slopes	983	.2
Mobeetie fine sandy loam, 1 to 3 percent slopes	4,747	.8
Mobeetie fine sandy loam, 3 to 5 percent slopes	11,665	2.0
Mobeetie fine sandy loam, 5 to 12 percent slopes	18,860	3.2
Mobeetie, Veal, and Pastura soils, rolling	19,700	3.4
Ness clay	4,471	.8
Pastura complex, hilly	16,339	2.8
Rough broken land	12,482	2.1
Sherm silty clay loam, 0 to 1 percent slopes	266,578	45.6
Sherm silty clay loam, 1 to 3 percent slopes	9,960	1.7
Springer fine sandy loam, 5 to 8 percent slopes	1,094	.2
Springer and Likes soils, undulating	9,457	1.6
Sunray loam, 0 to 1 percent slopes	16,831	2.9
Sunray loam, 1 to 3 percent slopes	27,805	4.8
Tascosa gravelly soils, hilly	16,978	2.9
Tascosa, Mobeetie, and Springer soils, rolling	3,828	.7
Tivoli fine sand, hummocky	6,320	1.1
Ulysses-Sunray complex, 3 to 5 percent slopes	15,601	2.7
Ulysses-Sunray complex, 5 to 8 percent slopes	5,611	1.0
Veal fine sandy loam, 1 to 3 percent slopes	1,452	.2
Veal fine sandy loam, 3 to 8 percent slopes	2,751	.5
Vernon clay loam, 3 to 8 percent slopes	558	.1
Total land area	578,953	99.0
Water (Lake Meredith)	6,007	1.0
Total	584,960	100.0

Capps Series

The Capps series consists of deep, loamy soils that are underlain by soft caliche.

In a representative profile the surface layer is clay loam about 15 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The next layer is light-brown clay loam about 20 inches thick. The lower part of this layer contains about 5 percent white caliche masses. The underlying material, reaching to a depth of 60 inches, is light reddish-brown clay loam that contains about 40 percent white masses of calcium carbonate.

Capps soils are moderately permeable and have high available water capacity. They are well drained. The hazard of soil blowing is slight to moderate. The hazard of water erosion is moderate on the gently sloping soils.

Representative profile of Capps clay loam, 0 to 1 percent slopes, 225 feet east of Farm Road 2589, 2.8 miles south of U.S. Highway 87, 3 miles west of its intersection with AT&SFRR tracks in Dumas; 950 feet north and 225 feet east of southwest corner sec. 198, block 44:

A11—0 to 10 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and fine, subangular blocky structure; hard, friable; common pores 1 to 2 millimeters in diameter; few worm casts in lower part; neutral; clear, smooth boundary.

A12—10 to 15 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium and fine, subangular blocky structure; hard, friable; 10 to 20 percent, by volume, worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B2—15 to 22 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 4/2) moist; weak, fine, subangular blocky and granular structure; slightly hard, very friable; common pores 1 to 2 millimeters in diameter; about 25 percent, by volume, worm casts; few scattered calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—22 to 35 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; slightly hard, friable, roots throughout; approximately 5 percent, by volume, soft, white masses of calcium carbonate; much finely divided calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

Cca—35 to 60 inches, light reddish-brown (5YR 6/3) clay loam, reddish brown (5YR 4/4) moist; massive (structureless); hard, friable; porous; many very fine root channels; intermixed white masses of calcium carbonate make up about 40 percent by volume; calcareous; moderately alkaline.

The A horizon is dark brown, brown, or dark grayish brown. The B2 horizon is light brown or grayish brown. Depth to the B3ca horizon ranges from 20 to 30 inches. The Cca horizon is light reddish brown, pale brown, pink, light brown, or pinkish gray. Depth to the Cca horizon ranges from 30 to 60 inches. Visible lime in the Cca horizon ranges from 5 percent to about 60 percent; total lime content ranges from 15 to 80 percent but averages about 40 percent by volume.

Capps clay loam, 0 to 1 percent slopes (CaA).—This soil is intermingled with Sherm, Dumas, and Harney soils in smooth areas. Slopes are generally plane or convex and are dominantly less than one-half percent. Areas of this soil are 15 acres to about 100 acres in size and oblong or oval in shape.

This soil has the profile described as representative for the series.

Included with this soil in mapping are some areas less than 5 acres in size of Conlen and Sunray soils. In a few areas this Capps soil is calcareous at the surface because of overwash.

Most areas of this soil are cultivated. A few areas are in native range. Water enters this soil easily, and runoff is very slow. The hazards of water erosion and soil blowing are slight. Capability units IIIce–2, dryland, and I–2, irrigated; Deep Hardland range site.

Capps clay loam, 1 to 3 percent slopes (CaB).—This soil is around playas and along draws. The slopes are dominantly convex and commonly about 2 percent. Most areas are oblong or long and narrow and 15 to 40 acres in size.

The surface layer is neutral, dark grayish-brown clay loam about 12 inches thick. The next layer is light-brown, calcareous clay loam about 18 inches thick. The underlying material, reaching to a depth of 60 inches, is pale-brown clay loam that contains 5 to 40 percent soft masses of calcium carbonate.

Included with this soil in mapping are areas less than 5 acres in size of Conlen, Harney, and Sunray soils.

This soil is mostly cultivated. A few areas are in native range. This soil is easy to till. Runoff is very slow. Water erosion is a moderate hazard, and soil blowing is a slight hazard. Capability units IIIe–2, dryland, and IIe–1, irrigated; Deep Hardland range site.

Cass Series

The Cass series consists of deep, loamy, bottom-land soils that are subject to occasional overflow. These soils are in narrow areas along creeks and streams.

In a representative profile the surface layer is brown fine sandy loam about 12 inches thick. The next layer is brown fine sandy loam about 13 inches thick. Below this is light-brown fine sandy loam about 15 inches thick. The underlying material, reaching to a depth of 60 inches, is dark grayish-brown loam that contains strata of loamy fine sand and clay loam.

Cass soils are moderately rapidly permeable. They have moderate available water capacity.

Representative profile of Cass fine sandy loam, calcareous, in native range, approximately 4 miles east and 1.5 miles north of Four Way, along Grapevine Creek, 1,000 feet south and 1,800 feet west of northeast corner sec. 22, block 44:

A1—0 to 12 inches, brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; moderate, coarse, prismatic structure parting to weak, subangular blocky and granular; hard, very friable; common worm casts; few waterworn caliche pebbles; mostly between 2 and 4 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

B21—12 to 25 inches, brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 4/2) moist; moderate, coarse, prismatic structure parting to granular; hard, very friable; common worm casts; common fine pores; few very fine caliche pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

B22—25 to 40 inches, light-brown (7.5YR 6/4) fine sandy loam, dark brown (7.5YR 4/2) moist; moderate, coarse, prismatic structure parting to granular in worm casts; slightly hard, very friable; few subrounded caliche pebbles ranging from 5 to 10 millimeters in diameter; few worm casts and few fine roots throughout; calcareous; moderately alkaline; clear, smooth boundary.

C—40 to 60 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; few fine strata of loamy fine sand and clay loam; massive (structureless); hard, friable, slightly sticky; few fine roots; white veins of calcium carbonate throughout; calcareous; moderately alkaline.

The A horizon is dark gray, grayish brown, brown, or dark grayish brown. Faint lenses of varying texture are throughout this horizon in most profiles. The B2 horizon is brown, light brown, or grayish brown. The C horizon ranges from loamy fine sand to loam and clay loam in texture.

Cass fine sandy loam, calcareous (Cf).—This soil is in narrow areas on bottom lands. The areas are 200 to 600 feet wide. Some areas are more than a mile long. These areas are dissected by a ditchlike, entrenched channel 4 to 10 feet deep and 10 to 40 feet wide. This channel carries most runoff. Floodwater occasionally overflows the channel banks.

Included with this soil in mapping are small areas of Lincoln, Manzano, and Humbarger soils.

This soil is not farmed. It is used for native range. This soil is well drained. Runoff is slow. The hazard of soil blowing is moderate. Capability unit Vw–1, dryland; Loamy Bottomland range site.

Conlen Series

The Conlen series consists of deep, nearly level to sloping, calcareous, loamy soils that overlie soft caliche.

In a representative profile the surface layer is calcareous, grayish-brown loam about 10 inches thick. The next layer is calcareous, friable, pale-brown clay loam that extends to a depth of about 17 inches. Below this, and extending to a depth of about 30 inches, is pink clay loam that is about 35 percent soft to cemented masses of calcium carbonate. Below the caliche is reddish-yellow clay loam that extends to a depth of 60 inches.

Conlen soils are moderately permeable and have high available water capacity. They are well drained. The hazard of soil blowing is moderate to severe.

Representative profile of Conlen loam, 1 to 3 percent slopes, approximately 2 miles southwest of Armstrong gasoline plant or 19 miles east and 3 miles south of Dumas, 300 feet due west of gas well on west side of ranch road:

A1—0 to 10 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky and granular structure; slightly hard, friable; many roots; many fine pores; many worm casts; common strongly cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

B21ca—10 to 17 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak, coarse, prismatic structure parting to weak, fine and medium, subangular blocky; slightly hard, friable; many worm casts; many films and threads of calcium carbonate; few weakly to strongly cemented calcium carbonate concretions 5 to 15 millimeters in diameter; estimated 30 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual, smooth boundary.

B22ca—17 to 30 inches, pink (7.5YR 7/4) clay loam, brown (7.5YR 5/4) moist; weak, coarse, prismatic structure parting to weak, fine and medium, subangular blocky; hard, friable; 35 percent, by volume, soft masses and cemented calcium carbonate concrecretions 5 to 30 millimeters in diameter; calcareous; moderately alkaline; diffuse, wavy boundary.

B23t—30 to 60 inches, reddish-yellow (5YR 7/6) clay loam, yellowish red (5YR 5/6) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; extremely hard, firm; white coatings of calcium carbonate on ped faces; calcareous; moderately alkaline.

The A horizon ranges from 7 to 10 inches in thickness and is grayish brown or brown in color. The B2ca horizon is pale brown, light brown, pink, or light reddish brown. Structure of the B2ca horizon ranges from subangular blocky to granular. The B23t horizon is reddish yellow to yellowish red.

Conlen loam, 0 to 1 percent slopes (CoA).—This soil occupies oval or oblong areas that are 10 to 30 acres in size. Slopes are mostly plane and less than one-half percent.

The surface layer is grayish-brown, calcareous loam about 10 inches thick. The next layer is pale-brown, calcareous clay loam that contains scattered caliche concretions. This layer extends to a depth of about 17 inches. Below this, to a depth of about 30 inches, is pink clay loam that contains 10 to 40 percent soft, white calcium carbonate masses. Below this layer, and reaching to a depth of 60 inches, is reddish-yellow clay loam.

Included with this soil in mapping are small spots and patches of Pastura and Capps soils.

This soil is used mostly for range. Cultivated areas are intermingled with larger areas of other soils. This soil is moderately susceptible to soil blowing. Capability units IVe–9, dryland, and IIIe–10, irrigated; Hardland Slopes range site.

Conlen loam, 1 to 3 percent slopes (CoB).—This soil soil is on the upper parts of hills and ridges and the upper side slopes of creeks and draws. A few areas are around playas. Slope is dominantly about 2 percent. The areas are 20 acres to about 100 acres in size.

This soil has the profile described as representative for the series.

Included with this soil in mapping are areas less than 5 acres in size of Sunray, Capps, and Pastura soils. A few spots of a soil that is similar to this Conlen soil but is underlain by indurated caliche flagstones and cobblestones are included. This stony soil is difficult to till. Also included are a few eroded spots of Conlen soils that have lost 4 to 6 inches of the surface layer.

This soil is used mostly for range. Cultivated areas are intermingled with larger areas of other soils. Water erosion and soil blowing are moderate hazards. Capability units IVe–9, dryland, and IIIe–10, irrigated; Hardland Slopes range site.

Conlen loam, 3 to 5 percent slopes (CoC).—This soil is mostly on the upper and middle parts of hills and ridges. It is also in narrow belts along draws and around playas. Slopes are dominantly about 4 percent and are convex.

The surface layer is brown, calcareous loam about 7 inches thick. The next layer is light-brown clay loam, about 8 inches thick, that contains common to many worm casts, scattered calcium carbonate concretions, and many veins and threads of calcium carbonate. Below this, extending to a depth of about 30 inches, is pink clay loam that contains calcium carbonate concretions. Below this calcareous layer is reddish-yellow clay loam that reaches to a depth of 60 inches.

Included with this soil in mapping are a few small spots of Veal, Pastura, Sunray, and Mobeetie soils.

Most of this soil is used for range. A few areas are cultivated. Good management is needed to maintain tilth and to control erosion. The hazard of water erosion is severe, and the hazard of soil blowing is moderate. Capability units IVe–2, dryland, and IVe–6, irrigated; Hardland Slopes range site.

Conlen loam, 5 to 8 percent slopes (CoD).—This soil has convex to plane slopes, mostly about 7 percent.

The surface layer is calcareous, brown loam about 7 inches thick. The next layer is pale-brown, calcareous clay loam that extends to a depth of about 15 inches. The next layer, extending to a depth of about 28 inches, is light-brown clay loam that contains calcium carbonate concretions. Below this calcareous layer is reddish-yellow clay loam that reaches to a depth of about 60 inches.

Included with this soil in mapping are small areas of Veal, Pastura, and Mobeetie soils.

This soil is not suited to cultivation. All areas are in range. Surface runoff is rapid. The hazards of soil blowing and water erosion are severe. Capability unit VIe–1, dryland; Hardland Slopes range site.

Dalhart Series

The Dalhart series consists of deep, nearly level to gently sloping, loamy soils on uplands.

In a representative profile the surface layer is brown, neutral fine sandy loam about 9 inches thick. The next layer is brown, friable sandy clay loan about 21 inches thick. Below this is brown sandy clay loam caliche about 5 inches thick. The underlying material is reddish-yellow fine sandy loam that reaches to a depth of 45 inches.

Dalhart soils are moderately permeable and have high available water capacity. They are well drained.

Representative profile of Dalhart fine sandy loam, 0 to 1 percent slopes, approximately 2 miles north and 2 miles east of junction of U.S. Highways 287 and 87 in Dumas, 450 feet east and 225 feet north of southwest corner sec. 312:

A—0 to 9 inches, brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky and granular structure; hard, very friable; few worm casts in lower part; neutral; clear, smooth boundary.

B2t—9 to 20 inches, brown (7.5YR 5/3) sandy clay loam, dark brown (7.5YR 4/3) moist; moderate, very coarse, prismatic structure parting to granular and subangular blocky; hard, friable; about 30 percent, by volume, worm casts; common root channels 1 to 3 millimeters in diameter; few clay films on prism faces; neutral; gradual, wavy boundary.

B3ca—20 to 30 inches, brown (7.5YR 5/4) sandy clay loam, brown (7.5YR 4/4) moist; moderate, medium, subangular blocky and granular structure; hard, friable; common pores 1 to 3 millimeters in diameter; about 30 percent worm casts; common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—30 to 35 inches, brown (7.5YR 5/4) sandy clay loam, brown (7.5YR 4/4) moist; moderate to weak, fine, subangular blocky structure; hard, friable; few roots in upper part, many very fine root channels; about 3 percent soft veins and masses of visible lime; total lime content estimated to be 15 to 20 percent; calcareous; moderately alkaline; gradual, wavy boundary.

C2—35 to 45 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak, fine, subangular blocky structure; hard, friable; porous many very fine root channels; estimated 1 to 2 percent, by volume, veins of calcium carbonate that form a fine network throughout the soil mass; calcareous; moderately alkaline.

The A horizon ranges from 9 to 12 inches in thickness. It is dark grayish brown, grayish brown, or brown. The B2t horizon has a similar range of color. It averages about 25 percent clay and ranges from 20 to 30 percent in clay content. Depth to the B3ca horizon ranges from 15 to 25 inches. The Cca horizon is at a depth of 28 to 45 inches. It ranges from fine sandy loam to clay loam. It is brown, pale brown,

or pinkish white. It ranges from 3 to 5 percent visible lime and 10 to 20 percent total calcium carbonate to segregated chalky white caliche and about 50 percent calcium carbonate. The C2 horizon is reddish yellow, very pale brown, pale brown, light brown, pink, or light yellowish brown. Its texture ranges from fine sandy loam to clay loam.

Dalhart fine sandy loam, 0 to 1 percent slopes (DaA).—This soil is smooth. It is on low rises. The areas are about oval in shape and range from 25 acres to several hundred acres in size.

This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas that consist principally of Dumas, Sunray, Harney, and Conlen soils. Some areas of Dumas and Harney soils are up to 20 acres in size but make up no more than 10 percent of any area mapped as this Dalhart soil. Also included are a few areas of a soil similar to this Dalhart soil but noncalcareous to a depth of 25 to 40 inches, and another soil that is similar to this soil but has a dark brown to very dark brown surface layer.

Most areas of this soil are in crops. The soil is well suited to irrigation. A few areas are used for range. This soil is less droughty than most other soils in Moore County. The hazard of water erosion is slight, and the hazard of soil blowing is moderate. This soil is susceptible to plowpan formation. Capability units IIIe-4, dryland, and IIe–4, irrigated; Sandy Loam range site.

Dalhart fine sandy loam, 1 to 3 percent slopes (DaB).—This soil is on low rises. Slopes are dominantly about 2 percent and convex. The areas are oblong to oval and mainly between 20 and 150 acres in size.

The surface layer is brown, neutral fine sandy loam about 10 inches thick. The next layer, about 26 inches thick, is brown, friable sandy clay loam that is neutral in the upper part and calcareous and moderately alkaline in the lower part. The underlying material, reaching to a depth of about 48 inches, is calcareous, friable sandy clay loam that contains some soft masses of calcium carbonate.

Included with this soil in mapping are areas less than 5 acres in size of Dumas, Harney, Conlen, and Sunray soils.

Most areas of this soil are used for crops. The soil is suited to irrigation if bench leveled or if a sprinkler system is used. A few areas are used for range. Runoff is slow, and the hazards of water erosion and soil blowing are moderate. This soil is susceptible to plowpan formation. Capability units IIIe–4, dryland, and IIe–6, irrigated; Sandy Loam range site.

Dalhart fine sandy loam, 3 to 5 percent slopes (DaC).—This soil has slopes that are plane to convex and commonly about 4 percent. The areas are oval to long and narrow and are between 30 and 60 acres in size.

The surface layer is brown fine sandy loam about 9 inches thick. The next layer is brown, friable sandy clay loam about 21 inches thick. The underlying material is pale-brown sandy clay loam that reaches to a depth of about 50 inches.

Included with this soil in mapping are areas of Tascosa, Dumas, Manzano, Humbarger, and Springer soils. A few areas of soil similar to this Dalhart soil but having redder color below a depth of 10 inches are also included.

Most areas of this soil are used for range. A few areas are farmed with less sloping adjacent soils to square up a field. The hazard of soil blowing is moderate, and the hazard of water erosion is severe. This soil is also susceptible to plowpan and hoofpan formation. Capability units IVe 4, dryland, and IVe–2, irrigated; Sandy Loam range site.

Dumas Series

The Dumas series consists of deep, loamy, nearly level to gently sloping soils on uplands.

In a representative profile the surface layer is brown loam about 11 inches thick. The next layer extends to a depth of about 37 inches. It is neutral, brown clay loam in the upper part, and light-brown, calcareous and moderately alkaline clay loam in the lower part. The underlying material is pink, calcareous silty clay loam that reaches to a depth of 64 inches.

These soils are moderately permeable and have high available water capacity. They are well drained. Runoff is slow to medium.

Representative profile of Dumas loam, 0 to 1 percent slopes, 0.3 mile north of Middlewell, 1,650 feet north and 100 feet east of southwest corner sec. 119:

Ap—0 to 6 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; hard, friable; neutral; abrupt, smooth boundary.

A1—6 to 11 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; moderate, coarse, prismatic structure and weak, fine, subangular blocky structure; hard, friable; common vertically oriented pores 1 to 2 millimeters in diameter; 15 to 25 percent, by volume, worm casts; neutral; clear, smooth boundary.

B2t—11 to 24 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 3/4) moist; moderate, coarse, prismatic structure parting to moderate, medium and fine, subangular blocky structure; hard, friable; common pores 1 to 2 millimeters in diameter; few clay films on prism faces; 20 to 30 percent, by volume, worm casts; neutral; clear, wavy boundary.

B3ca—24 to 37 inches, light-brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate, medium, prismatic structure parting to weak, fine, subangular blocky structure; hard, friable; roots throughout; few calcium carbonate threads; few worm casts in upper part; calcareous; moderately alkaline; abrupt, wavy boundary.

C1ca—37 to 58 inches, pink (7.5YR 8/4) silty clay loam, pink (7.5YR 7/4) moist; massive (structureless); slightly hard, friable; estimated 50 percent, by volume, soft calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—58 to 64 inches, pink (7.5YR 7/4) silty clay loam; light brown (7.5YR 6/4) moist; massive (structureless); slightly hard, friable; estimated 40 percent, by volume, soft to weakly cemented calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 10 to 12 inches in thickness. Color is dark brown, dark grayish brown, or brown. The B2t horizon ranges from brown to reddish brown in color. The B3ca horizon ranges from light brown to reddish brown in color and extends to a depth of 28 to 45 inches. The Cca horizon is light brown to white clay loam or silty clay loam. Visible lime in the Cca horizon ranges from 5 to 60 percent; and total lime content ranges from 20 to 75 percent.

Dumas loam, 0 to 1 percent slopes (DmA).—This soil is smooth. Most areas are on low rises that are slightly higher than the level of the plain. Slopes are convex and dominantly between ½ and 1 percent. The areas are

round to oval and from 50 acres to several hundred acres in size.

This soil has the profile described as representative for the series.

Included areas of Harney soils make up 5 to 10 percent of the mapped acreage of this Dumas soil. Also included are small areas of Dalhart, Capps, Sunray, and Conlen soils.

Most areas of this soil are cultivated. Some areas are irrigated. A few areas are used for range. The hazards of water erosion and soil blowing are slight. Capability units IIIcc–2, dryland, and I–2, irrigated; Deep Hardland range site.

Dumas loam, 1 to 3 percent slopes (DmB).—This soil is on uplands. Areas range from 10 acres to about 300 acres in size. They are oval or elongated and have wavy boundaries.

The surface layer is neutral, brown, friable loam about 10 inches thick. The next layer, about 26 inches thick, is brown, friable clay loam. It is neutral in the upper part and calcareous in the lower part. The underlying material, to a depth of 60 inches, is calcareous clay loam intermingled with soft and weakly cemented white masses of calcium carbonate.

Included with this soil in mapping are small areas of Conlen and Sunray soils. Also included are a few areas of Dalhart and Harney soils up to 20 acres in size, which make up less than 10 percent of any area mapped as this Dumas soil.

Most areas of this soil are cultivated. A few small areas are used for range. The hazard of water erosion is moderate. Capability units IIIe–2, dryland, and IIe–1, irrigated; Deep Hardland range site.

Dumas loam, 3 to 5 percent slopes (DmC).—Areas of this soil are along draws and around playas. The slopes are dominantly convex and are mainly about 4 percent. The areas are 10 acres to several hundred acres in size.

The surface layer is brown loam about 10 inches thick. The next layer is brown clay loam that reaches to a depth of about 24 inches. It is neutral in the upper part and calcareous in the lower part. The underlying material extends to a depth of about 50 inches; it is calcareous clay loam in which soft and cemented masses of calcium carbonate are common.

Included with this soil in mapping are small areas of Conlen, Humbarger, Ulysses, and Dalhart soils.

Most areas of this soil are used for range. A few small areas are used for crops. Runoff is medium. The hazard of water erosion is moderate to severe. Capability units IVe–1, dryland, and IIIe–2, irrigated; Deep Hardland range site.

Dumas and Tascosa soils, rolling (DtC).—These gently undulating to rolling soils are on smooth knolls and ridges 10 to 20 feet high. The areas are oval to oblong and are about 50 acres to more than 500 acres in size. Dumas soils occupy the lower parts of the knolls and ridges and have slopes of 2 to 5 percent. Tascosa soils have slopes of 5 to 10 percent and are on the smooth, convex crests of the knolls and ridges. Dumas loam makes up 60 to 80 percent of this undifferentiated group; Tascosa gravelly loam, 15 to 30 percent; and Uylsses, Dalhart, and Manzano soils, in narrow valleys between the ridges, 5 to 15 percent.

Dumas loam has a brown loam surface layer about 10 inches thick. The next layer, to a depth of about 30 inches, is friable, reddish-brown clay loam. It is neutral in the upper part and calcareous in the lower part. The underlying material is calcareous clay loam that reaches to a depth of 60 inches.

Tascosa gravelly loam formed in beds of rounded, waterworn quartz gravel. The surface layer is brown gravelly loam about 9 inches thick. The next layer is pinkish-gray very gravelly loam about 4 inches thick. The underlying material is pink very gravelly sandy loam that reaches to a depth of 50 inches. Much of the gravel is coated with lime, and much of the material around the gravel is lime.

The Dumas soil is deep and has high available water capacity. The Tascosa soil is shallow to caliche and has low available water capacity.

This unit is all in range. Dumas loam in capability unit IVe–1, dryland; Deepland Hardland range site. Tascosa gravelly loam in capability unit VIIs–3, dryland; Gravelly range site.

Ector Series

The Ector series consists of very shallow to shallow gravelly soils that are over thick, massive beds of limestone. These soils are in scattered areas along escarpments (fig. 5).

In a representative profile the surface layer is calcareous, brown gravelly loam about 8 inches thick. The gravel in this layer is subangular limestone fragments. The material below the surface layer is white to light-gray limestone plates. Roots penetrate only the soil-filled cracks between the plates.

These soils are moderately permeable and have low available water capacity. They are well drained. They are dry most of the year and support a very sparse cover of native plants.

Representative profile of an Ector gravelly loam in an area of Ector-Ulysses complex, hilly, 15 miles east and 3.2 miles south of Four Way, from intersection of main drainageway of Evans' Canyon and the conservation pool level of Lake Meredith, 4,200 feet south by 35° east to a point 250 feet west of Y in fence, or 400 feet south of National Park boundary:

A1—0 to 8 inches, brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; soft, very friable; few fine roots; 50 percent, by volume, subangular limestone fragments, mainly between 5 and 12 millimetetrs in diameter; fragments and gravel increase to about 60 percent, by volume, in lower 2 inches; calcareous; moderately alkaline; clear, irregular boundary.

R—8 to 15 inches, white to light-gray limestone plates 12 to 30 inches across and 3 to 6 inches thick; cracks and crevasses between plates make up about 10 percent, by volume, and to a depth of about 15 inches contain some roots and light-brown loam.

The solum ranges from 4 to 12 inches in thickness, is brown to grayish brown, and has a gravel content of from 45 to 60 percent. The R layer is 4 inches to several feet thick over soft limestone or clayey red beds. In most places it consists of overlapping limestone plates 3 to 6 inches thick. In a few places it consists of massive dolomitic limestone slabs 2 to 3 feet thick and 3 to 6 feet across.

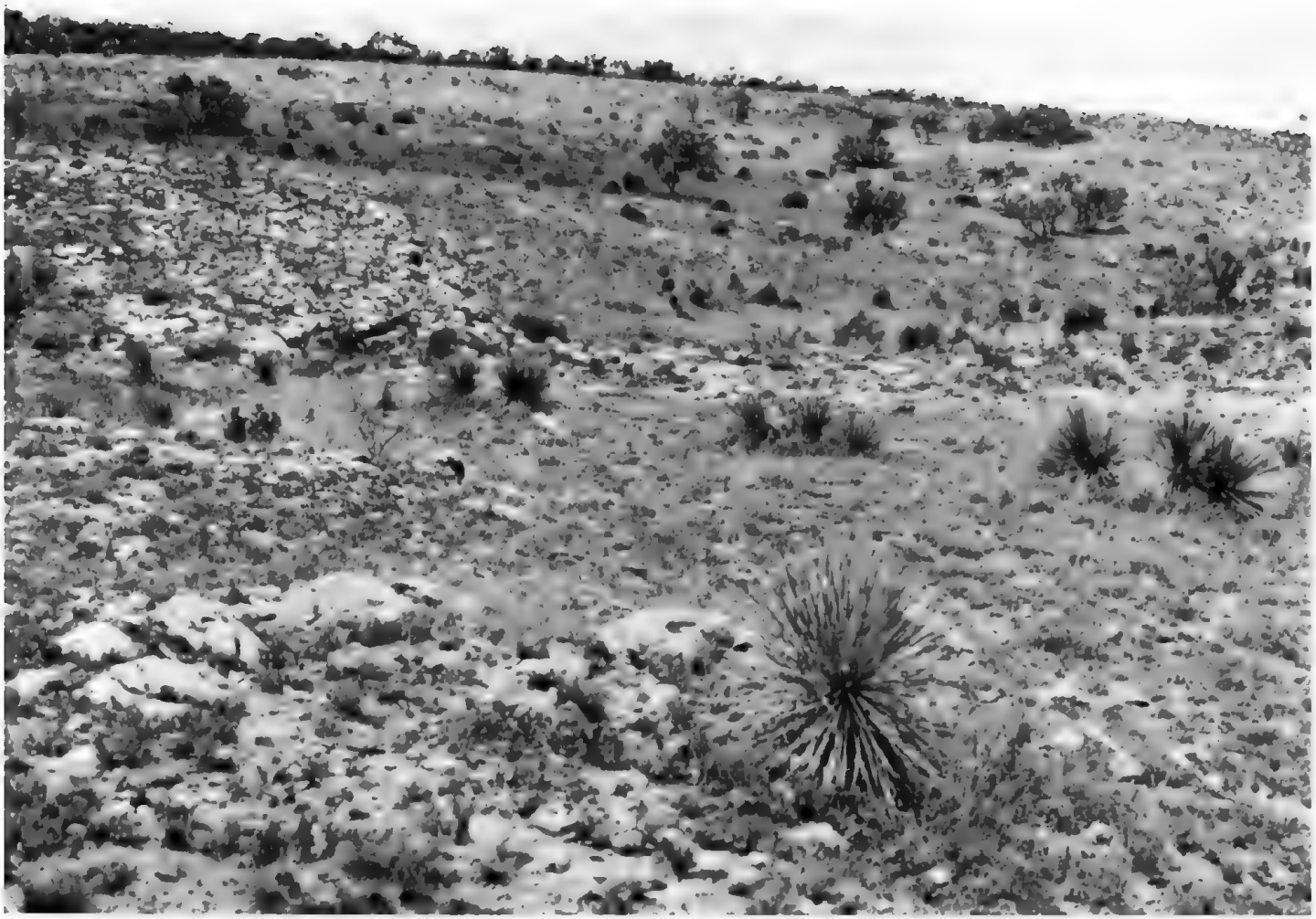

Figure 5.—Area of Ector-Ulysses complex, hilly. Ector soils are shallow and are intermingled with the rock outcrops. Ulysses soils are deeper and are on the lower slopes.

Ector-Ulysses complex, hilly (EcE).—The soils in this complex are in narrow belts along the contour of canyon escarpments. The Ector soil is on the upper parts of ridges, and the Ulysses soil is on the lower toe slopes of foot slopes near the escarpments. Areas of this soil complex are a few hundred feet to a mile long. The slopes are commonly about 15 percent but range from 3 to 30 percent. The Uylsses soil has slopes of less than 8 percent.

Ector gravelly loam makes up about 45 percent of this complex, and Ulysses loam about 25 percent. About 30 percent is small areas of Enterprise and Tascosa soils and rock outcrops.

The Ulysses soil has a brown, calcareous loam surface layer about 10 inches thick. The next layer is brown, very friable clay loam about 10 inches thick. The underlying material is light-brown, calcareous clay loam that is 5 to 15 percent loose gravel. This material reaches to a depth of 50 inches.

This complex is all in range. It is not suited to crops. Both soils in capability unit VIIs–1, dryland; Ector gravelly loam in Very Shallow range site, Ulysses loam in Deep Hardland range site.

Enterprise Series

The Enterprise series consists of deep, loamy soils that formed in red beds. These soils occupy foot slopes and valley fills below red-bed escarpments (fig. 6).

In a representative profile the soil is reddish-brown very fine sandy loam that reaches to a depth of about 50 inches.

Enterprise soils are moderately rapidly permeable and have high available water capacity. They are well drained.

Representative profile of Enterprise very fine sandy loam, 5 to 8 percent slopes, 14 miles east and 3 miles north of Four Way, 3,300 feet south and 1,700 feet east of confluence of Pollard and Blue Creeks, 700 feet south of gas well:

A1—0 to 8 inches, reddish-brown (5YR 4/4) very fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, subangular blocky structure; slightly hard, very friable; common worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B21—8 to 24 inches, reddish-brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; moderate, very coarse, prismatic structure parting to weak, very fine, granular; slightly hard, very fri-

Figure 6.—**Area of Enterprise soils on foot slopes and valley fills below escarpments and broken areas.**

able; estimated 50 percent, by volume, worm casts; few veins and threads of calcium carbonate in old root channels; calcareous; moderately alkaline; gradual, smooth boundary.

B22—24 to 50 inches, reddish-brown (2.5YR 5/4) very fine sandy loam, reddish brown (2.5YR 4/4) moist; very coarse, prismatic structure parting to weak, fine, granular; slightly hard, very friable; many old root channels, few roots; many films and veins of calcium carbonate and few, white, soft, irregularly shaped lime masses; calcareous; moderately alkaline.

The A horizon ranges from 7 to 12 inches in thickness. It is reddish brown, light reddish brown, light brown, or brown. The B2 horizon is reddish brown or reddish yellow.

Enterprise very fine sandy loam, 5 to 8 percent slopes (EnD).—This soil occupies areas below escarpments, mesas, and buttes. The slopes are mainly about 6 percent and convex. Areas are about 20 acres to several hundred acres in size. In some of the smaller canyons, the areas are long and narrow and are dissected by a stream channel. Other areas are on broader foot slopes, where the canyon walls widen out to form a rolling plain.

Included with this soil in mapping are a few areas of a soil that is similar to this Enterprise soil but is underlain by sandstone at a depth of 10 to 20 inches. Also included are a few sandstone outcrops, some narrow gullies, and a few areas of Enterprise soils that have slopes of 3 to 5 percent.

This soil is all in range. It is not suited to cultivation. Capability unit VIe–1, dryland; Mixedland range site.

Harney Series

The Harney series consists of nearly level to gently sloping, deep, noncalcareous, loamy soils. These soils are on broad ridges and divides.

In a representative profile the surface layer is dark-brown clay loam about 12 inches thick. Below this is dark-brown clay loam about 6 inches thick. The next layer is brown clay loam about 18 inches thick. Below this is reddish-yellow clay loam about 4 inches thick. The underlying material, reaching to a depth of 60 inches, is pink clay loam that contains about 40 percent calcium carbonate.

Harney soils are well drained. Available water capacity is high, and permeability is moderately slow. The hazard of water erosion is moderate where soils are more sloping. The hazard of soil blowing is slight.

Representative profile of Harney clay loam, 0 to 1 percent slopes, 7.5 miles west of junction of U.S. Highways 87 and 287 in Dumas, 950 feet west and 125 feet south of northeast corner sec. 245:

Ap—0 to 6 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky and granular structure; hard, friable; neutral; clear, smooth boundary.

A1—6 to 12 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium and fine, subangular blocky structure; hard, friable; few worm casts; neutral; clear, smooth boundary.

B21t—12 to 18 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium and coarse, blocky structure; very hard, firm; few clusters of worm casts; few root channels 1 to 3 millimeters in diameter, but blocks are mostly nonporous; common clay films; neutral; clear, smooth boundary.

B22t—18 to 36 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak, blocky to moderate, fine and medium, subangular blocky structure; very hard, friable; roots throughout; common clay films on ped surfaces; few clusters of worm casts; about 3 percent less clay than in B21t horizon; calcareous; moderately alkaline; clear, smooth boundary.

B3ca—36 to 40 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 4/6) moist; weak, medium, subangular blocky structure; hard, friable, few roots; common veins and threads of calcium carbonate; calcareous; moderately alkaline; abrupt, wavy boundary.

C1ca—40 to 52 inches, pink (7.5YR 7/4) clay loam, reddish yellow (7.5YR 6/6) moist; massive (structureless); slightly hard, friable; estimated 5 to 10 percent, by volume, soft, white masses of calcium carbonate; total lime content is estimated at more than 40 percent; calcareous; moderately alkaline; gradual, wavy boundary.

C2—52 to 60 inches, pink (7.5YR 7/4) clay loam, reddish yellow (7.5YR 6/6) moist; massive (structureless); slightly hard, friable; estimated 5 to 10 percent, by volume, soft, white masses of calcium carbonate; estimated 30 percent total calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 9 to 14 inches in thickness. It is dark brown, brown, or grayish brown. The B2t horizon is reddish brown, brown, or dark brown to dark grayish brown. Depth to the Cca horizon ranges from 28 to 50 inches. The Cca horizon is 10 to 50 percent lime.

Harney clay loam, 0 to 1 percent slopes (HaA).—This soil occupies smooth areas. Slopes are commonly less than one-half percent. Most areas are broad, oval, and several hundred acres in size.

This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Sherm, Dumas, Dalhart, and Sunray soils. These soils make up 5 to 10 percent of most areas.

Most areas of this soil are used for cultivated crops. A few small areas are used for range. The soil is well suited to irrigation. It is easy to till. Runoff is slow. The hazard of soil blowing is slight. Capability units IIIce–2, dryland, and I–1, irrigated; Deep Hardland range site.

Harney clay loam, 1 to 3 percent slopes (HaB).—This soil occupies broad plains, ridges, and divides on uplands. Slopes are commonly about 2 percent. Most areas are between 50 to 200 acres in size.

The surface layer is neutral, dark-brown clay loam about 10 inches thick. The next layer is brown clay loam about 30 inches thick. The underlying material, reaching to a depth of 60 inches, is pink, soft caliche.

Most areas of this soil are in cultivated crops. A few areas are used for range. This soil is easy to till. The hazard of soil blowing is slight. The hazard of water erosion is moderate. Capability unit IIIe–2, dryland, and IIe–2, irrigated; Deep Hardland range site.

Humbarger Series

The Humbarger series consists of deep, well-drained, friable, loamy soils on bottom lands. These soils are on flood plains along creeks and streams.

In a representative profile the surface layer is grayish-brown loam about 15 inches thick. Below this, and reaching to a depth of 60 inches, is brown clay loam.

Most areas of Humbarger soils are subject to occasional flooding. The soils are moderately permeable. Available water capacity is high. The hazard of soil blowing is slight.

Representative profile of Humbarger loam, 0.7 mile north of Palo Duro school, 400 feet due east of concrete dip crossing, on east side of stream channel:

A11—0 to 15 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and fine, subangular blocky structure; hard, friable; common worm casts; many roots; calcareous; moderately alkaline; gradual, smooth boundary.

A12—15 to 21 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, coarse, prismatic structure parting to moderate, fine, subangular blocky and granular; hard, friable; 20 to 30 percent, by volume, worm casts; pores and root channels 1 to 3 millimeters in diameter; few threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B2—21 to 30 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable; few worm casts; common roots, fine root channels throughout; most root channels lined with thin calcium carbonate films; calcareous; moderately alkaline; gradual, smooth boundary.

C1—30 to 55 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; few thin strata of loam; massive (structuresless); hard, friable; few fine roots throughout; coatings of calcium carbonate in most root channels; calcareous; moderately alkaline; gradual, smooth boundary.

C2—55 to 60 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; massive (structureless); hard, friable; few worm casts; few fine roots; calcium carbonate coatings as above; calcareous; moderately alkaline.

The A horizon ranges from 20 to 40 inches in thickness. Color when moist is dark brown, dark grayish brown, very dark grayish brown, or grayish brown. Bedding planes or strata, above a depth of 30 inches are faint or not evident, and most areas have distinct layering below this depth. These strata are loam, clay loam, or fine sandy loam in texture.

Humbarger loam (Hu).—This soil is on bottom lands at the upper end of creeks and draws. The areas are 150 to about 800 feet wide, and some are more than a mile long. This soil is on smooth bottoms that have been dissected by channels 10 to 40 feet wide. These channels carry the runoff from most rains. They meander from side to side across the bottoms and leave irregularly shaped areas of Humbarger soils on each side. These areas are less than an acre to about 20 acres in size. Water occasionally overflows the channel banks and floods the bottoms.

Included with this soil in mapping are small areas of Manzano, Cass, and other Humbarger soils.

Most areas of this soil are in range. A few small areas are cropped. Capability unit Vw–1, dryland; Loamy Bottomland range site.

Likes Series

The Likes series consists on undulating to hummocky, deep, loose, sandy soils on uplands.

In a representative profile the surface layer is brown, loose loamy fine sand about 8 inches thick. The underlying material is pale-brown, loose loamy fine sand that extends to a depth of about 20 inches. Below this, and reaching to a depth of 50 inches, is pinkish-gray, loose loamy fine sand.

Likes soils are moderately rapidly permeable and have low available water capacity. They are excessively drained. Runoff is slow. The hazard of soil blowing is severe.

Representative profile of Likes loamy fine sand, hummocky, in range, approximately 16 miles east and 6 miles south of Dumas, 0.9 miles north of ranch house, or about 1.7 miles southwest of natural gas compression plant, on west side of road, 200 feet south of bend in road:

A—0 to 8 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak, fine, granular structure; loose, very friable; common worm casts; noneffervescent in upper 3 inches, calcareous below; moderately alkaline; gradual, smooth boundary.

C1—8 to 20 inches, pale-brown (10YR 6/3) loamy fine sand, brown (7.5YR 4/4) moist; single grain (structureless); loose, very friable; few strings of worm casts; few etched caliche pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

C2—20 to 50 inches, pinkish-gray (7.5YR 7/2) loamy fine sand, brown (7.5YR 5/4) moist; single grain (structureless); loose, very friable; few roots in upper part; 3 to 5 percent soft calcium carbonate masses, calcareous; moderately alkaline.

The A horizon ranges from 6 to 12 inches in thickness. It is pale brown, light brown, grayish brown, or brown.

Likes loamy fine sand, hummocky (lkC).—This soil is undulating to hummocky. Slopes dominantly range from 1 to 5 percent but are as steep as 8 percent on some short hummocky side slopes. Areas are broad and mostly more than 100 acres in size.

This soil has the profile described as representative for the series.

This soil is all in range. It is not suited to cultivation, The hazard of soil blowing is severe. Capability unit VIe–5, dryland; Sandyland range site.

Likes complex, hummocky (lIC).—This complex is on uplands. The relief is characterized by shallow draws, gullies, mounds, hummocks, and irregularly shaped, sandstone-capped knolls. Slopes dominantly are 1 to 5 percent but are as steep as 10 percent on the short side slopes of some hummocks. Most areas are several hundred acres in size.

About 70 percent of this complex is Likes soils; 17 percent is a soil that is similar to Likes soils but is underlain by soft to weakly cemented sandstone at a depth of 4 to 10 inches; and 13 percent is other soils, including Mobeetie and Tivoli soils and a soil that is similar to Likes soils but is underlain by caliche at a depth of about 30 inches.

The Likes soils have a calcareous, brown loamy fine sand surface layer about 6 inches thick. The next layer is loose, pale-brown loamy fine sand about 12 inches thick. The underlying material is loose, pinkish-gray loamy sand that reaches to a depth of 50 inches.

This complex is all in range. Permeability is moderately rapid in the Likes soils and very slow in the soil that is underlain by sandstone. The hazards of soil blowing and water erosion are severe. Capability unit VIe–5, dryland; Sandyland range site.

Lincoln Series

The Lincoln series consists of deep, sandy soils on flood plains along creeks and tributaries.

In a representative profile the surface layer is pale-brown, calcareous loamy fine sand about 8 inches thick. The underlying material reaches to a depth of 60 inches. The upper 24 inches is pale-brown loamy fine sand, the next 6 inches is light brownish-gray fine sandy loam, and the lower 22 inches is very pale brown fine sand.

Most areas of Lincoln soils are only occasionally flooded, although most areas lie next to the stream channel. These soils are rapidly permeable, have low available water capacity, and are somewhat excessively drained. The hazard of soil blowing is severe.

Representative profile of Lincoln loamy fine sand, 5 miles south of Dumas along U.S. Highway 287, 200 feet east of Big Blue Creek bridge, and 100 feet north of streambed:

A1—0 to 8 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; weak, fine, granular structure; soft, very friable; many fine roots; calcareous; moderately alkaline; clear, smooth boundary.

C1—8 to 32 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain (structureless); loose; few roots; calcareous; moderately alkaline; clear, smooth boundary.

C2—32 to 38 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; soft, very friable; few roots; scattered worm casts; few caliche pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

C3—38 to 60 inches, very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grain (structureless); loose; no roots; few waterworn quartz and caliche pebbles; calcareous; moderately alkaline.

The A horizon ranges from 7 to 15 inches in thickness. The C horizon ranges from loamy fine sand to fine sand and has thin layers of fine sandy loam.

Lincoln loamy fine sand (ln).—This soil occupies narrow bottoms 200 to 800 feet wide along creeks and tributaries. It is on flood plains 5 to 20 feet above the main stream channels, which meander from side to side across the bottoms. This soil is nearly level but has a slightly moundy microrelief because of blowing of the surface layer. It formed in sandy alluvium that consists mainly of stratified loamy fine sand and sand.

Included with this soil in mapping are stream-wash channels 10 to 40 feet wide. Small areas of Cass and Likes soils occur in most areas mapped as this Lincoln soil.

All areas of this soil are in range. Most areas are occasionally flooded. The water table is below a depth of 6 feet in most places. The hazard of soil blowing is severe. Capability unit Vw–2, dryland; Sandy Bottomland range site.

Manzano Series

The Manzano series consists of deep, loamy soils. These soils occur on valley fills along shallow draws.

In a representative profile the surface layer is neutral, dark grayish-brown clay loam to a depth of 20 inches. Below this, and extending to a depth of about 32 inches, it is dark-brown, mildly alkaline clay loam. The underlying material is brown clay loam to a depth of about 40 inches. Below this, and reaching to a depth of 60 inches, it is light-brown clay loam.

Manzano soils are friable and easy to work. They are moderately permeable and have high available water capacity. They are well drained. The hazard of soil blowing is moderate.

Representative profile of Manzano clay loam, 1 to 3 percent slopes, approximately 2 miles east and 2 miles north of Four Way, 1,600 feet east of northwest corner sec. 24, block 44, on south side of fence about 30 feet east of draw:

A11—0 to 10 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 3/2) moist; moderate, medium and fine, subangular blocky and granular structure; hard, friable; common worm casts and nests in lower part; neutral; gradual, smooth boundary.

A12—10 to 20 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate, coarse, prismatic and granular structure; hard, friable; 15 to 25 percent, by volume, worm casts; common pores, mostly vertically oriented and 1 to 2 millimeters in diameter; neutral; gradual, smooth boundary.

A13—20 to 32 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable; few worm casts; few pores 1 to 2 millimeters in diameter; mildly alkaline; gradual, smooth boundary.

C1ca—32 to 40 inches, brown (7.5YR 5/3) clay loam, brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable; few roots; common threads and veins of calcium carbonate and white coatings in old root channels; calcareous; moderately alkaline; gradual, smooth boundary.

C2ca—40 to 60 inches, light-brown (7.5YR 6/3) clay loam, brown (7.5YR 4/3) moist; hard, friable; common white coatings and threads of calcium carbonate; few roots; calcareous; moderately alkaline.

Color of the A horizon is dark brown, dark grayish brown, or very dark grayish brown. Color of the Cca horizon is brown or light brown.

Manzano clay loam, 1 to 3 percent slopes (MaB).—This soil is on valley fills in smooth draws. It receives runoff from the adjoining slopes but is not flooded. The slopes are gentle and concave and mainly between 1 and 2 percent. Areas are 300 to 700 feet wide and 20 to 50 acres in size.

Included with this soil in mapping are small areas of Dalhart, Dumas, Humbarger, and Sunray soils. Also included are a few areas of a Manzano soil that has a fine sandy loam surface layer 4 to 8 inches thick.

Most areas of this soil are in range. A few areas are used for crops. Capability units IIIe–2, dryland, and IIe–1, irrigated; Deep Hardland range site.

Mobeetie Series

The Mobeetie series consists of deep, calcareous, loamy soils. These soils are mainly on foot slopes below escarpments and on the lower parts of hills and ridges.

In a representative profile the surface layer is grayish-brown, calcareous fine sandy loam about 10 inches thick. The next layer, reaching to a depth of about 20 inches, is light brownish-gray fine sandy loam. The underlying material is light-brown, calcareous fine sandy loam that reaches to a depth of 40 inches (fig. 7).

These soils are moderately rapidly permeable, have a moderate available water capacity, and are well drained. Runoff is medium.

Representative profile of Mobeetie fine sandy loam, 5 to 12 percent slopes, exposed on west bank of gulley, 7.5 miles south of Dumas on west side of U.S. Highway 287, 600 feet south of Little Blue Creek:

A1—0 to 10 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, granular; slightly hard, very friable; common worm casts; few calcium carbonate concretions 3 to 5 millimeters in diameter scattered throughout; cal-

Figure 7.—**Profile of Mobeetie fine sandy loam.**

careous; moderately alkaline; gradual, smooth boundary.

B2—10 to 20 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate, coarse, prismatic structure parting to weak, granular; soft, very friable; estimated 50 to 75 percent, by volume, worm casts; common etched calcium carbonate concretions, mostly between 2 and 6 millimeters in diameter; common threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

Cca—20 to 40 inches, light-brown (7.5YR 6/3) fine sandy loam, brown (7.5YR 5/3) moist; moderate, coarse, prismatic structure; slightly hard, very friable; few worm casts in upper part; calcium carbonate concretions scattered throughout; calcareous; moderately alkaline.

The A horizon ranges from 7 to 12 inches in thickness. Color is grayish brown, pale brown, or light brown. The B2 horizon ranges from fine sandy loam to loam. Structure is prismatic parting to granular and subangular blocky. Color is light brownish gray or pale brown. The C horizon ranges from loam to fine sandy loam, and to loamy fine sand in a few places.

In some of the soils named for this series, the soil temperature is a few degrees cooler than is defined as the range for the series, but this difference does not alter their usefulness or behavior.

Mobeetie fine sandy loam, 1 to 3 percent slopes (MrB).—This soil is below caliche escarpments and on the lower parts of knolls, hills, and ridges. The slopes are dominantly about 2 percent.

The surface layer is grayish-brown, calcareous fine sandy loam about 11 inches thick. The next layer, extending to a depth of about 20 inches, is calcareous, light brownish-gray fine sandy loam. The underlying material, reaching to a depth of 40 inches, is friable, calcareous sandy loam that contains many threads and veins of calcium carbonate.

Included with this soil in mapping are small areas of Pastura, Likes, and Veal soils.

This soil is all in range. The hazard of soil blowing is moderate. Capability units IIIe–6, dryland, and IIIe–6, irrigated; Mixedland Slopes range site.

Mobeetie fine sandy loam, 3 to 5 percent slopes (MrC).—This soil is below the caliche escarpment of the High Plains and on the lower parts of knolls, hills, and ridges in the Canadian Breaks. The slopes are plane to convex and are dominantly about 4 percent. Areas are 25 to 200 acres in size and nearly round to oblong in shape.

The surface layer is calcareous, grayish-brown fine sandy loam about 10 inches thick. The next layer is very friable, pale-brown fine sandy loam. The underlying material is light-brown, very friable, calcareous fine sandy loam that reaches to a depth of about 40 inches.

Included with this soil in mapping are small areas of Dalhart, Likes, Manzano, Pastura, and Veal soils.

Most areas of this soil are used for range. A few small areas are cultivated. Runoff is usually medium. The hazard of soil blowing is moderate. Capability units IVe–5, dryland, and IVe–2, irrigated; Mixedland Slopes range site.

Mobeetie fine sandy loam, 5 to 12 percent slopes (MrD).—This soil is on footslopes below caliche escarpments and on the middle and lower parts of hills and ridges. Slope is dominantly about 7 percent. The downslope surface is plane to convex. The cross-slope surface is wavy. The areas range from 20 acres to more than 1,000 acres in size. Some areas are long and narrow, and others are oblong or nearly round.

This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Dalhart, Likes, Manzano, Pastura, and Veal soils.

This soil is used for range. It is not suited to cultivation. Runoff is medium. The hazard of soil blowing is moderate. The hazard of water erosion is moderately severe. A few deep gullies have formed in this soil from the washing out of old cattle trails and roads. Capability unit VIe–2, dryland; Mixedland Slopes range site.

Mobeetie, Veal, and Pastura soils, rolling (MvC).—These soils are gently sloping and rolling in a circular belt that follows the margin of the High Plains and extends 2 miles to about 4 miles into the Canadian Breaks. The topography is characterized by hills and ridges formed by the branching tributaries of the Canadian River. The hills and ridges are 20 to 100 feet high. They have smooth, convex slopes of 3 percent to about 12 percent. Narrow, smooth-bottomed drains lie between the hills and ridges and flow into the larger creeks and draws downstream. Some areas of this mapping unit are on foot slopes below escarpments. Areas are broad and up to 400 acres in size.

The pattern of soils in this mapping unit is fairly uniform. Mobeetie soils are on the lower parts of hills and ridges and extend down to the draws. Veal soils occupy the crests and upper parts of hills and ridges. Pastura soils are intermingled with the Veal soils in spots.

Mobeetie fine sandy loam makes up 30 to 60 percent of this mapping unit, Veal fine sandy loam 20 to 40 percent, and Pastura soils 10 to 20 percent. Likes, Conlen, Dalhart, and other soils make up 5 to 10 percent.

Mobeetie fine sandy loam has a surface layer of grayish-brown fine sandy loam about 8 inches thick. The next layer is pale-brown fine sandy loam that extends to a depth of about 20 inches. The underlying material is light-brown fine sandy loam that reaches to a depth of 40 inches.

Veal fine sandy loam has a surface layer of light brownish-gray fine sandy loam about 8 inches thick. The next layer is light brownish-gray sandy clay loam that extends to a depth of about 15 inches. Below this is pink fine sandy loam.

Pastura soils have a surface layer of pale-brown gravelly loam about 8 inches thick. It is underlain by white caliche.

This undifferentiated group is all in range. Mobeetie and Veal soils in capability unit VIe–2, dryland; Mixedland Slopes range site. Pastura soils in capability unit VIIs–1, dryland; Very Shallow range site.

Ness Series

The Ness series consists of deep, poorly drained, clayey soils on the floors of playas.

In a representative profile the surface layer is dark-gray clay to a depth of about 16 inches. Below this it is gray, neutral clay that extends to a depth of about 40

inches. The underlying material is gray clay that reaches to a depth of 60 inches.

Ness soils are very slowly permeable. After initial wetting the soil material swells, runs together, and seals. Because the movement of water downward almost stops after sealing, the water impounded in the playas is removed almost entirely by evaporation. When the soil is dry, cracks form that are ½ inch to about 3 inches wide and 30 to 50 inches deep. The hazard of soil blowing is moderate because Ness soils become powdery at the surface when dry and generally lack plant cover.

Representative profile of Ness clay, 2.3 miles east of Dumas, 1,075 feet east of western edge of playa, and 20 feet north of road right-of-way:

A11—0 to 16 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, coarse, blocky structure parting to very fine, angular blocky; extremely firm, sticky; few, round, black, ashy concretions of iron or manganese; upper 2 inches has very fine granular structure and many roots; neutral; gradual, smooth boundary.

A12—16 to 40 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak to moderate, coarse, blocky structure, some tendency to form wedges; extremely hard, extremely firm; peds have shiny exteriors; few grooved surfaces (slickensides); few black iron or manganese concretions; neutral; gradual, wavy boundary.

C—40 to 60 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; extremely hard, extremely firm; common, faint, brown mottles; few roots; concretions as above; neutral.

The A11 horizon ranges from 12 to 20 inches in thickness. Most areas have 1 to 2 inches of clayey surface mulch that has fine and very fine, granular structure. The A12 horizon extends to a depth of 23 to 45 inches. The C horizon is gray, light gray, or grayish brown.

Ness clay (Nc).—This soil occupies bottoms of playas or enclosed depressions. The playas catch most of the runoff from the nearly level tablelands. This soil is under water for a few weeks to several months each year. The bottoms of the playas are 1 foot to about 10 feet below the surrounding plain. The areas are nearly round, somewhat oval, or egg shaped and range from a fraction of an acre to more than 100 acres in size.

Included with this soil in mapping are a few narrow areas of Conlen, Sherm, Capps, and Sunray soils in some of the larger areas mapped as Ness clay.

These soils are used mainly for grazing. A few playas are cultivated where the area has been drained. Capability units VIw–1, dryland (undrained); IVs–1, dryland (drained); and IIIs–1, irrigated (drained). Included in range site with soils that surround it.

Pastura Series

The Pastura series consists of gently sloping to moderately steep, limy, gravelly soils that are very shallow to shallow over thick beds of weakly to strongly cemented caliche (fig. 8).

In a representative profile the surface layer is calcareous, pale-brown gravelly loam 8 inches thick. Caliche pebbles make up about 20 percent, by volume, of this layer. Below this the underlying material is white caliche. It consists of caliche pebbles in the upper few inches that grade to weakly cemented caliche as depth increases.

Figure 8.—**Sparse vegetation on Pastura soils in range. Caliche pebbles litter the surface.**

These soils are moderately permeable and have low available water capacity. They are well drained.

Representative profile of Pastura gravelly loam in area of Pastura complex, hilly, 8.5 miles east of Four Way on south side of Farm Road 1913, 30 feet south of roadside fence, and 2,500 feet west of northeast corner sec. 54:

A1—0 to 8 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak, fine, granular structure; soft, very friable; common worm casts; about 20 percent, by volume, strongly cemented caliche pebbles 8 to 15 millimeters in diameter; calcareous; moderately alkaline; clear, wavy boundary.

Ccam—8 to 18 inches, white (10YR 8/2) caliche that consists of loose pebbles in upper 3 to 4 inches and grades to weakly cemented caliche below.

The A horizon ranges from 4 to 12 inches in thickness. Color is pale brown, brown, or grayish brown. Content of gravel ranges from 10 to 35 percent by volume. The C horizon consists of loose, unconsolidated caliche pebbles. These pebbles grade to massive caliche that is weakly to strongly cemented.

Pastura complex, hilly (PaE).—The soils in this complex are gently sloping to moderately steep. Slopes range from 1 to 20 percent. Most areas are 200 to 500 feet

wide and up to 1 mile long. Other areas on crests of hills or ridges, are round or oval. The areas range from 10 acres to about 60 acres in size.

About 60 percent of the acreage of this complex is Pastura soils. About 20 percent is soils that are similar to Pastura soils, except that the caliche substratum is soft enough to be dug with a spade, or more than one-third of the clay fraction consists of clay-sized carbonates. The remaining 20 percent is small areas of Conlen, Mobeetie, and Veal soils.

This complex is all in range. It is not suited to cultivation. Capability unit VIIs–1, dryland; Very Shallow range site.

Rough Broken Land

Rough broken land (Ro) consists of escarpments, jagged bluffs, canyons, foot slopes, and severely gullied areas. Areas of this land type are irregular and generally elongated. They are 200 to 700 feet wide and a few hundred feet to more than a mile long. Some areas form the boundary between the High Plains and the Canadian Breaks. These areas are narrow, nearly continuous, white to buff-colored bluffs, locally known as the caprock, that are intermingled with gullied areas. They have steep to nearly vertical slopes and are largely exposures of caliche.

Mapped with this broken land are small areas of several soils. In some places, Veal, Pastura, Mobeetie, Uylsses, and Conlen soils are intermingled with caliche. In other places, Ector, Tascosa, Vernon, and Enterprise soils occur within areas of red beds.

Geologic erosion is active on Rough broken land. The slopes are so steep in most places that the plant cover is not sufficient to prevent very rapid runoff. Most areas have a sparse plant cover.

This land type is in range. Some of the steeper areas are not accessible to cattle and horses. Capability unit VIIs–2, dryland; Rough Breaks range site.

Sherm Series

The Sherm series consists of nearly level to gently sloping, deep, loamy soils of the High Plains.

In a representative profile the surface layer is grayish-brown silty clay loam about 6 inches thick. The next layer is about 44 inches thick. The upper 13 inches is neutral, dark-brown clay; and next 26 inches is calcareous, brown clay; and the lower 5 inches is calcareous, reddish-brown clay loam. The underlying material is soft caliche and is 25 to 75 percent calcium carbonate. It is pink clay loam to a depth of about 65 inches. Below this it is reddish-yellow clay loam that reaches to a depth of 72 inches.

Sherm soils are very slowly permeable. Water moves into and through them at a moderate rate on initial wetting, but then the soil swells and tends to seal. Thereafter, water moves downward very slowly. The soils crack when dry. They have high available water capacity and are well drained.

Representative profile of Sherm silty clay loam, 0 to 1 percent slopes, 2.5 miles west and 1.5 miles south of Dumas, 650 feet north of irrigation well, 2,000 feet south and 150 feet west of northwest corner sec. 224, block 44:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; slightly hard, friable, slightly sticky; few dark-brown soil aggregates throughout (apparently from horizon below); neutral; clear, smooth boundary.

B21t—6 to 14 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; weak, coarse, blocky structure parting to fine and very fine, irregular blocky; peds have sharp vertices on all corners; very hard, firm, sticky; shiny surfaces on peds when moist; roots penetrate soil mass but tend to follow ped surfaces; neutral; clear, smooth boundary.

B22t—14 to 19 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium, blocky structure; peds have longer horizontal than vertical axes; very hard, firm, sticky; surfaces of peds shiny (clay films or pressure faces); roots tend to follow ped surfaces; pores in peds are mostly less than one-half millimeter in diameter; neutral; clear, smooth boundary.

B2tca—19 to 25 inches, brown (7.5YR 5/3) clay, dark brown (7.5YR 4/3) moist; moderate, medium, blocky structure; very hard, firm, sticky; common roots and pores; patchy clay films; few, soft, white masses of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B2b1—25 to 45 inches, brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate, medium, blocky structure; very hard, firm, sticky; few roots in lower part; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B2b2—45 to 50 inches, reddish-brown (5YR 5/4) clay loam, yellowish red (5YR 4/6) moist; weak, medium, blocky structure; hard, friable, slightly sticky; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cab—50 to 65 inches, pink (5YR 8/3) clay loam, pink (5YR 7/4) moist; 50 to 75 percent finely divided calcium carbonate particles and soft white masses; calcareous; moderately alkaline; gradual, smooth boundary.

C2cab—65 to 72 inches, reddish-yellow (5YR 7/6) clay loam, light brown (7.5YR 6/4) moist; 25 to 40 percent, by volume, soft white masses and finely divided particles of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 4 to 7 inches in thickness. It is brown, grayish brown, or dark grayish brown. The B21t horizon extends to a depth of 10 to 15 inches. It has weak, coarse, blocky structure to moderate, medium, blocky structure. The B22t horizon has moderate to strong, medium, blocky structure. Depth to a calcareous layer or to the B2tca horizon is 15 to 25 inches. The B2b1 and B2b2 horizons range from clay to clay loam in texture. Depth to the C1cab horizon ranges from 30 inches to about 75 inches.

Sherm silty clay loam, 0 to 1 percent slopes (ShA).—This soil is on a smooth, nearly level, featureless plain that has a slight decline to the southeast and falls an average of about 15 feet per mile. The soil is largely in one continuous area of the High Plains and contains scattered areas of soils.

This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Harney, Conlen, Dalhart, Sunray, Ness, and Dumas soils. These soils make up an average of 5 to 15 percent of any area mapped as this Sherm soil.

Most areas of this soil are used for crops. This soil is well suited to furrow irrigation. Runoff is slow. There

is little or no ponding that damages growing crops. Soil blowing and water erosion are slight hazards. Capability units IIIce–1, dryland, and IIs–1, irrigated; Deep Hardland range site.

Sherm silty clay loam, 1 to 3 percent slopes (ShB).—Areas of this soil are elongated. Some encircle playas, and others are in narrow belts. Slopes are convex and commonly about 2 percent. The areas are 500 feet to about 1,000 feet in width.

The surface layer is grayish-brown silty clay loam about 6 inches thick. The next layer is about 48 inches thick. In sequence from the top, the upper 12 inches is dark-brown, neutral clay; the next 32 inches is brown, calcareous clay; and the lower 4 inches is reddish-brown clay loam. The underlying material, reaching to a depth of 66 inches, is pink, soft clay loam that contains calcium carbonate.

Included with this soil in mapping are small areas of Conlen, Harney, and Sunray soils. These included areas make up 5 to 10 percent of mapped acreage.

Most areas of this soil are cropped. A few areas are used for range. Runoff is medium. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. Capability units IIIe–1, dryland, and IIIe–1, irrigated; Deep Hardland range site.

Springer Series

The Springer series consists of gently undulating and sloping, deep, neutral, loamy and sandy soils on uplands.

In a representative profile the surface layer is brown loamy fine sand about 12 inches thick. The next layer is brown fine sandy loam that extends to a depth of about 30 inches. The underlying material is light-brown fine sandy loam that reaches to a depth of 60 inches.

Springer soils are well drained, have moderate available water capacity, and are moderately rapidly permeable. The hazard of soil blowing is severe.

Representative profile of Springer loamy fine sand in an area of Springer and Likes soils, undulating, about 10 miles east and 5 miles south of Dumas, about 1,900 feet northwest of windmill about 0.25 mile northwest of ranch foreman's headquarters, 100 feet south of ranch road, opposite old gas well site, sec. 9, block M1:

A1—0 to 12 inches, brown (7.5YR 5/2) loamy fine sand, brown (7.5YR 4/2) moist; single grain (structureless); soft to loose; many roots; neutral; gradual, smooth boundary.

B21t—12 to 18 inches, brown (7.5YR 5/2) fine sandy loam, brown (7.5YR 4/2) moist; weak, very coarse, prismatic structure parting to weak, medium and fine, granular; soft, very friable; neutral; gradual, smooth boundary.

B22t—18 to 30 inches, brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak, very coarse, prismatic structure parting to weak, fine, granular; soft, very friable; common roots; neutral; gradual, smooth boundary.

C—30 to 60 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, fine, granular structure; soft, very friable; few roots throughout; neutral.

The A horizon ranges from 10 to 20 inches in thickness. Texture is loamy fine sand or fine sandy loam. Color is light brown, brown, or dark brown. The B2t horizon is fine sandy loam. Clay content ranges from 8 to 18 percent. The C horizon is loamy fine sand to fine sandy loam.

In some of the soils named for this series, the soil temperature is a few degrees cooler than in the range defined for the series, but this difference does not alter their usefulness or behavior.

Springer fine sandy loam, 5 to 8 percent slopes (SrD).—This soil is on hills and ridges along draws and creeks. The slopes are plane to convex and are commonly about 7 percent. The areas are 30 to 80 acres in size.

The surface layer is brown, neutral fine sandy loam about 10 inches thick. The next layer, extending to a depth of about 30 inches, is neutral, brown fine sandy loam. The underlying material, reaching to a depth of 60 inches, is light-brown fine sandy loam that contains films and threads of calcium carbonate.

Included with this soil in mapping are small areas of Likes, Mobeetie, and Tascosa soils.

This soil is all in range. Runoff is slow. Capability unit VIe–2, dryland; Sandy Loam range site.

Springer and Likes soils, undulating (SsB).—The soils in this mapping unit are in undulating and hummocky areas on side slopes of broad plains in the uplands. The slopes are dominantly about 2 percent but range from 1 to 4 percent. They are 50 to 150 feet long. The areas are several hundred acres in size.

These soils are in no particular pattern. In some places Springer soils occupy the crests of hummocks and Likes soils are in the vales or interhummock areas. In other places the pattern is the opposite.

Springer loamy fine sand makes up 45 to 65 percent of this mapping unit, Likes loamy fine sand 30 to 50 percent, and other soils 5 to 10 percent.

Springer loamy fine sand has the profile described as representative for the Springer series.

Likes loamy fine sand has a surface layer of pale-brown loamy fine sand about 8 inches thick. The underlying material is pale-brown loamy fine sand that extends to a depth of about 20 inches. Below this is neutral, pinkish-gray loamy fine sand that reaches to a depth of 60 inches.

These soils are used for range. They are not suited to cultivation. They are moderately rapidly permeable and have low to moderate available water capacity. The hazard of soil blowing is severe. Capability unit VIe–5, dryland; Sandyland range site.

Sunray Series

The Sunray series consists of nearly level to gently sloping, deep, calcareous, loamy soils. These soils formed in eolian deposits of calcareous clay loam on broad uplands.

In a representative profile the surface layer is grayish-brown loam about 12 inches thick. The next layer is brown clay loam about 10 inches thick. Below this is pink clay loam about 12 inches thick. The underlying material is reddish-yellow clay loam that reaches to a depth of 60 inches.

Sunray soils are moderately permeable and well drained. Available water capacity is high.

Representative profile of Sunray loam, 0 to 1 percent slopes, 2 miles north and 0.2 mile east of northeast corner of Dumas townsite, 1,150 feet east and 200 feet north of southwest corner sec. 311, block 44:

Ap—0 to 12 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky and granular structure; slightly hard, very friable; few, strongly cemented, white calcium carbonate concretions 0.5 to 1.5 millimeters in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

B21t—12 to 22 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky and granular; slightly hard, friable; common worm casts and nests; few clay films; few strongly cemented calcium carbonate concretions 2 to 5 millimeters in diameter; much disseminated calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B22tca—22 to 34 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; weak, fine, subangular blocky and granular structure; slightly hard, friable; many root channels; few worm casts; few clay films; estimated 20 percent, by volume, weakly cemented concretions and soft masses of calcium carbonate; much finely divided carbonates; calcareous; moderately alkaline; gradual, smooth boundary.

B23tca—34 to 60 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable; many, very fine, old root channels; clay films on ped faces; 5 to 8 percent, by volume, soft and weakly cemented masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon is grayish brown or brown. It ranges from 8 to 12 inches in thickness. The B2 horizon is brown, pink, or reddish yellow. Visible lime films, threads, and soft and hard masses make up 15 to 30 percent, by volume, of the B22tca horizon, and total content of carbonate ranges from 35 to 55 percent.

Sunray loam, 0 to 1 percent slopes (SuA).—This soil is in smooth areas that are nearly round to oval and have a wavy outer boundary. These areas average about 50 acres in size. Slopes are plane to convex and are commonly 0.3 percent.

This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Conlen, Harney, and Sherm soils.

Most areas of this soil are cultivated. A few areas are in range. Runoff is slow. The hazard of soil blowing is moderate. The hazard of water erosion is slight. Capability units IIIcc–3, dryland, and IIc 3, irrigated; Deep Hardland range site.

Sunray loam, 1 to 3 percent slopes (SuB).—Most areas of this soil are around playas or along draws and creeks. A typical area is elongated to oval and about 50 acres in size. Slopes are convex and are dominantly about 2 percent.

The surface layer is grayish-brown, calcareous loam about 10 inches thick. The next layer, about 10 inches thick, is friable, calcareous, brown clay loam. Below this is pink clay loam about 12 inches thick. The underlying material, reaching to a depth of 60 inches, is reddish-yellow clay loam.

Included with this soil in mapping are small spots of Conlen, Capps, Dumas, and Harney soils.

Most areas of this soil are in range. A few areas are cultivated. Runoff is medium. The hazards of soil blowing and water erosion are moderate. Capability unit IIIe–3, dryland, and IIIe–4, irrigated; Deep Hardland range site.

Tascosa Series

The Tascosa series consists of gravelly, gently sloping to steep soils on hills and ridges. These soils formed in beds of waterworn quartz gravel. They are shallow to moderately deep to soft caliche.

In a representative profile the surface layer is brown gravelly loam about 9 inches thick. The next layer, which extends to a depth of about 20 inches, is pinkish-gray very gravelly loam that is about 60 percent quartz gravel. The underlying material is pink very gravelly sandy loam that reaches to a depth of 60 inches.

The soils are moderately permeable, have low available water capacity, and are well drained.

Representative profile of Tascosa gravelly soils, hilly, 15 miles east and 3.5 miles south of Four Way, 400 feet east and 1,400 feet south of gate on west side of road, or 0.3 mile east and 1.1 mile south of junction of main drainageway of Evans Canyon and conservation pool level of Lake Meredith:

A1—0 to 9 inches, brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky and granular structure; slightly hard, very friable; few worm casts; estimated 35 percent, by volume, rounded quartzite pebbles 5 to 20 millimeters in diameter; 50 percent of surface covered with pebbles; calcareous; moderately alkaline; clear, smooth boundary.

Bca—9 to 13 inches, pinkish-gray (7.5YR 6/2) very gravelly loam, brown (7.5YR 4/2) moist; weak, fine, granular structure; soft, very friable; common roots; 60 percent, by volume, rounded quartzite pebbles 5 to 20 millimeters in diameter; thin lime coatings on lower sides of quartz pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—13 to 20 inches, pinkish-gray (7.5YR 6/2) very gravelly loam, brown (7.5YR 4/2) moist; slightly hard, very friable; few roots; 60 percent, by volume, rounded quartzite pebbles; estimated 50 percent of soil material less than 2 millimeters in diameter is calcium carbonate in the form of soft masses and coatings on pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

C2—20 to 60 inches, pink (7.5YR 7/4) very gravelly sandy loam, reddish yellow (7.5YR 6/6) moist; single grain (structureless); loose, very friable; 50 percent, by volume, quartzite pebbles 5 to 20 millimeters in diameter; about 10 percent, by volume, finely divided calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 12 to 22 inches in thickness. The A horizon is brown to dark brown in color. Texture is gravelly sandy clay loam, gravelly loam, or gravelly sandy loam. Gravel content ranges from 30 to 80 percent. The Bca horizon ranges from 3 to 10 inches in thickness and is 50 to 80 percent, by volume, rounded quartzite pebbles. It is mainly more than 50 percent, by volume, quartzite gravel and is 15 to 30 percent calcium carbonate. Texture of the C1ca horizon is dominantly very gravelly loam but ranges to gravelly loamy sand. The C2 horizon is pink to very pale brown very gravelly sandy loam to gravelly loamy sand and has 50 to 80 percent quartzite pebbles.

Tascosa gravelly soils, hilly (TaE).—This gently sloping to steep soil is on knolls, hills, and ridges. A branching stream pattern intertwines between the hills and ridges and carries runoff. The hills, knolls, and ridges are 10 to 40 feet high. The slopes are convex and are 3 percent to about 45 percent. The areas are dominantly 50 to 150 acres in size.

This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Mobeetie, Likes, Dumas, and Springer soils.

Most areas of these soils are in range. They are not suited to cultivation. A few small areas are mined for road-building materials. Runoff is rapid. The hazards of water erosion and soil blowing are slight. Capability unit VIIs–3, dryland; Gravelly range site.

Tascosa, Mobeetie, and Springer soils, rolling (TmC).—The soils in this mapping unit are on smooth knolls, hills, and ridges and in narrow draws that have a branching drainage system. The knolls, hills, and ridges are 15 to 40 feet high. The side slopes are dominantly convex and are 3 percent to about 20 percent. The interlying vales and draws are smoothly convex except for a few that have narrow, entrenched gullies. The areas are 50 acres to about 500 acres in size.

Tascosa soils occupy the crests and upper side slopes of the knolls, hills, and ridges. Mobeetie and Springer soils occupy the lower side slopes. Most areas of this mapping unit contain both Mobeetie and Springer soils. However, in some areas the main components are Tascosa and Springer soils, and in others the components are primarily Tascosa and Mobeetie soils.

Tascosa gravelly loam makes up 30 to 35 percent of the mapping unit, Mobeetie fine sandy loam 20 to 25 percent, Springer fine sandy loam about 15 percent, and Likes loamy fine sand 10 to 20 percent. The rest is small areas of Pastura and Cass soils and Rough broken land.

Tascosa gravelly loam has a surface layer of brown gravelly loam about 9 inches thick. The next layer is very gravelly loam to a depth of about 13 inches. Below this is pinkish-gray very gravelly loam, about 7 inches thick, that contains about 60 percent gravel. The underlying material, reaching to a depth of 60 inches, is pink very gravelly sandy loam.

Mobeetie fine sandy loam has a surface layer of grayish-brown, calcareous fine sandy loam about 10 inches thick. The next layer is light brownish-gray fine sandy loam about 10 inches thick. The underlying material, reaching to a depth of 40 inches, is friable, light-brown fine sandy loam.

Springer fine sandy loam has a surface layer of neutral, brown fine sandy loam about 10 inches thick. The next layer extends to a depth of about 30 inches and is neutral, brown, very friable fine sandy loam. The underlying material, reaching to a depth of 60 inches, is very friable, calcareous, light-brown fine sandy loam.

These soils are used for range. They are not suited to crops. Permeability is moderate to moderately rapid. Available water capacity is moderate to low. Runoff is slow to rapid. The hazard of soil blowing is slight to severe. The hazard of water erosion is slight to moderate. Tascosa part in capability unit VIIs–3, dryland; Gravelly range site. Mobeetie part in capability unit VIe–2, dryland; Mixedland Slopes range site. Springer part in capability unit VIe–2, dryland; Sandy Loam range site.

Tivoli Series

The Tivoli series consists of deep, sandy soils that formed in eolian sands. These soils occupy duned and hummocky areas.

In a representative profile the surface layer is brown fine sand about 8 inches thick. The underlying material is light-brown fine sand that reaches to a depth of 60 inches.

These soils are excessively drained, have low available water capacity, and are rapidly permeable. Runoff is very slow.

Representative profile of Tivoli fine sand, hummocky, 6,800 feet west of Farm Road 1913, 6 miles south of Texas Highway 152, 19 miles east of its intersection with U.S. Highways 287 and 87 in Dumas; 1,400 feet south of ranch road:

A—0 to 8 inches, brown (7.5YR 5/4) fine sand, brown (7.5YR 4/4) moist; single grain (structureless); loose, very friable; most roots in this horizon; neutral; gradual, smooth boundary.

C—8 to 60 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grain (structureless); loose; few grass roots in upper part, few yucca or sagebrush roots in lower part; neutral.

The A horizon ranges from 6 to 10 inches in thickness. It is pale brown, light brown, or brown. The C horizon is light-brown to pale-brown fine sand.

Tivoli fine sand, hummocky (TvC).—This soil is hummocky and duned. The hummocks and dunes are 3 to 20 feet high and have short side slopes that are 3 percent to about 12 percent. The areas average about 75 acres in size.

Included with this soil in mapping are small areas of Likes, Mobeetie, Veal, and Pastura soils.

This soil is all in range. The hazard of soil blowing is severe. Capability unit VIIe–1, dryland; Deep Sand range site.

Ulysses Series

The Ulysses series consists of gently sloping to sloping, deep, loamy, friable soils along draws. These soils formed in calcareous eolian deposits.

In a representative profile the surface layer is grayish-brown, calcareous loam about 11 inches thick. The next layer is calcareous, light-brown clay loam about 9 inches thick. The underlying material, extending to a depth of 25 inches, is light-brown clay loam and contains 10 to 15 percent calcium carbonate. Below this is reddish-yellow, calcareous clay loam that reaches to a depth of 60 inches.

Ulysses soils are moderately permeable. They have high available water capacity and are well drained.

Representative profile of Ulysses loam, in an area of Ulysses-Sunray complex, 3 to 5 percent slopes, about 0.75 mile north of Four Way, 20 feet west of fence line, and 1,700 feet south of northeast corner sec. 16, block 44:

A1—0 to 11 inches, grayish-brown (10YR 5/2) loam, very dark grayish-brown (10YR 3/2) moist; weak, fine, subangular blocky and granular structure; slightly hard, friable; common worm casts; abundant roots; few etched caliche pebbles on surface; calcareous; moderately alkaline; gradual, smooth boundary.

B2—11 to 20 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) moist; moderate, coarse, prismatic structure parting to weak, fine, subangular blocky and granular; slightly hard, very friable; 25 to 50 percent worm casts; white threads of calcium carbonate throughout the soil mass; few concretions 5 to 8 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—20 to 25 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) moist; moderate, coarse, prismatic structure parting to weak, fine, subangular blocky; slightly hard, very friable, slightly sticky; few worm casts in upper part; threads of calcium carbonate throughout; few coatings and films of calcium carbonate and few soft masses and concretions; 10 to 15 percent, by volume, total calcium carbonate, about 2 percent visible; calcareous; moderately alkaline; gradual, smooth boundary.

C2—25 to 60 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate, medium and coarse, subangular blocky structure; very hard, friable, slightly sticky; many very fine pores; few, white, soft masses of calcium carbonate throughout, about 3 percent by volume; approximately 10 percent calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 9 to 12 inches in thickness. It is brown to grayish brown. The B2 horizon is brown, light brown, or pale brown. Depth to the Cca horizon ranges from 20 to 26 inches. The Cca horizon is light brown to reddish brown. Total content of calcium carbonate is estimated at 8 to 15 percent.

Ulysses-Sunray complex, 3 to 5 percent slopes (UsC).—The soils in this complex are along draws and streams. The slopes are convex and commonly are about 4 percent. The areas are mainly between 20 and 200 acres in size. A few areas are around playas. The soils in this complex are intermingled in an irregular pattern. Each soil might occupy any part of the slope. The Ulysses soil makes up about 40 percent of this mapping unit, the Sunray soil 35 percent, Conlen soils 10 percent, Manzano soils 10 percent, and Veal soils 5 percent.

The Ulysses soil has the profile described as representative for the Ulysses series.

The Sunray soil has a surface layer of grayish-brown, calcareous loam about 9 inches thick. The next layer, extending to a depth of 20 inches, is brown clay loam that contains many veins and films of calcium carbonate and many worm casts. The underlying material is reddish-yellow clay loam that reaches to a depth of 60 inches.

Most areas of this complex are in range. A few areas are cultivated. Runoff is slow to medium. The hazard of soil blowing is moderate, and the hazard of water erosion is severe. Capability units IVe–2, dryland, and IIIe–2, irrigated; Deep Hardland range site.

Ulysses-Sunray complex, 5 to 8 percent slopes (UsD).—The soils in this complex are along draws and streams. The slopes are convex and commonly about 6 percent. The areas are dominantly 20 to 200 acres in size. The soils in this complex are intermingled in an irregular pattern. Each soil might occupy any part of the slope. Ulysses loam makes up about 40 percent of this mapping unit, and Sunray loam, 40 percent. The remaining 20 percent is Conlen, Manzano, and Veal soils.

Ulysses loam has a surface layer of grayish-brown, calcareous loam about 9 inches thick. The next layer, about 12 inches thick, is light-brown, calcareous, friable clay loam that contains a few soft masses of calcium carbonate. The underlying material, reaching to a depth of 60 inches, is calcareous, reddish-brown clay loam.

Sunray loam has a surface layer of brown loam about 8 inches thick. The next layer is brown clay loam about 15 inches thick. The underlying material is reddish-yellow clay loam that reaches to a depth of 60 inches.

This complex is all in range. Runoff is medium. The hazard of water erosion is severe, and the hazard of soil blowing is moderate. Capability unit VIe–1, dryland; Deep Hardland range site.

Veal Series

The Veal series consists of deep, calcareous, loamy soils on the crests and upper parts of hills and ridges.

In a representative profile the surface layer is light brownish-gray, calcareous fine sandy loam about 8 inches thick. The next layer, about 7 inches thick, is pale-brown, calcareous, very friable sandy clay loam that contains common calcium carbonate masses and concretions. The underlying material, reaching to a depth of 40 inches, is calcareous, pink fine sandy loam.

These soils are moderately permeable and have moderate available water capacity. They are well drained.

Representative profile of Veal fine sandy loam, 1 to 3 percent slopes, 1.1 miles south and 0.63 mile west of booster pump station 3 miles east of Four Way, on south side of ranch road:

A1—0 to 8 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky and granular structure; soft, very friable; many worm casts; few calcium carbonate concretions 1 to 3 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

B21—8 to 15 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak, fine, granular structure; soft, very friable; common soft to slightly cemented masses of calcium carbonate 5 to 10 millimeters in diameter; calcareous; moderately alkaline; clear, smooth boundary.

B22ca—15 to 20 inches, pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) moist; weak, fine, granular structure; slightly hard, very friable; approximately 35 percent, by volume, soft caliche masses and weakly cemented calcium carbonate bodies; common worm casts; calcareous; moderately alkaline; clear, wavy boundary.

B23ca—20 to 40 inches, pink (7.5YR 8/4) fine sandy loam, pink (7.5YR 7/4) moist; weak, fine, subangular blocky structure; soft, very friable; few roots in upper part; common weakly cemented bodies and soft powdery masses; calcareous; moderately alkaline.

The A horizon ranges from 6 to 10 inches in thickness. It is grayish brown, pale brown, light brownish gray, or brown. The B2 horizon is sandy clay loam or fine sandy loam. Its color is light brown, pale brown, pink, or light brownish gray. The B2ca horizon contains 20 to 50 percent visible carbonate in the form of weakly cemented bodies and soft masses.

In some of the soils of Moore County named for this series, the soil temperature is a few degrees cooler than is defined as the range for the series, but this difference does not alter their usefulness or behavior.

Veal fine sandy loam, 1 to 3 percent slopes (VeB).—This soil is on the upper parts of knolls, hills, and ridges. Slopes are convex and commonly about 2 percent.

This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Pastura, Dalhart, Mobeetie, and Conlen soils.

Most of this soil is in range. A few areas are cultivated. Runoff is medium. The hazard of soil blowing is severe, and the hazard of water erosion is moderate.

Capability unit IVe–10, dryland, and IIIe–10, irrigated; Mixedland Slopes range site.

Veal fine sandy loam, 3 to 8 percent slopes (VeD).—This soil is on the upper parts of knolls, hills, and ridges. The slopes are convex and commonly about 5 percent.

The surface layer is brown, calcareous fine sandy loam about 7 inches thick. The next layer, about 9 inches thick, is light-brown, very friable, calcareous sandy clay loam. The underlying material, reaching to a depth of 40 inches, is pink fine sandy loam.

Included with this soil in mapping are small areas of Pastura, Mobeetie, and Dalhart soils. These soils make up 10 to 15 percent of most areas mapped as this Veal soil.

This soil is all in range. Runoff is medium. The hazards of soil blowing and water erosion are severe. Capability unit VIe–2, dryland; Mixedland Slopes range site.

Vernon Series

The Vernon series consists of gently sloping to sloping, calcareous, loamy soils. These soils are moderately deep to red-bed clay or clayey shale.

In a representative profile the surface layer is reddish-brown clay loam about 7 inches thick. The next layer is reddish-brown clay that extends to a depth of about 36 inches. The underlying material is reddish-brown clay that extends to a depth of 45 inches.

These soils are very slowly permeable but well drained. Available water capacity is moderate.

Representative profile of Vernon clay loam, 3 to 8 percent slopes, 11 miles east and 6 miles south of Dumas, 4,200 feet south and 500 feet east of the junction of Big Blue and Little Blue Creeks, 0.5 mile east of pond, and 150 feet south of ranch road:

A1—0 to 7 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate, medium and fine, subangular blocky structure; very hard, friable, sticky; noncalcareous in upper 3 inches, calcareous below; moderately alkaline; clear, smooth boundary.

B21—7 to 14 inches, reddish-brown (5YR 5/3) clay, dark reddish brown (5YR 3/4) moist; moderate, medium and coarse, blocky structure; extremely hard, very firm, sticky; ped surfaces shiny when moist; few caliche pebbles 3 to 8 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

B22—14 to 36 inches, reddish-brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; moderate to strong, medium and coarse, blocky structure; extremely hard, very firm, sticky; few roots to depth of 24 inches; shiny pressure faces on ped surfaces; occasional quartz pebbles; few caliche pebbles, mostly less than 1 millimeter in diameter but ranging to about 5 millimeters; calcareous; moderately alkaline; gradual, smooth boundary.

C—36 to 45 inches, reddish-brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; massive (structureless); extremely hard, very firm, sticky; few soft masses and concretions of calcium carbonate, dominantly between ½ and 2 millimeters in diameter; calcareous; moderately alkaline.

The A horizon ranges from 6 to 10 inches in thickness. The B2 horizon has moderate to strong, blocky structure. The C horizon is calcareous, clayey earth that ranges to clayey shale. Depth to the shale stratum, where present, ranges from 20 to 38 inches.

Vernon clay loam, 3 to 8 percent slopes (VnD).—This soil is in scattered areas on foot slopes below escarpments, ridges, buttes, and small mesas. Typical areas lie at the base of escarpments and extend down to creek bottoms or to a flood plain. The slopes are convex and dominantly about 6 percent. Areas average about 50 acres in size. Most areas are oblong to narrow and are less than 700 feet wide.

Included with this soil in mapping are small areas of Enterprise soils and Rough broken land.

This soil is all in range. Runoff is rapid. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. Capability unit VIe–1, dryland; Shallow Redland range site.

Use and Management of the Soils

In this section the general management of the soils of Moore County and some principles basic to conservation are discussed. The principal objectives in managing the soils are to store as much rainfall as possible in the soil, to prevent water erosion and soil blowing, to use irrigation water efficiently, to keep the soil in good condition, and to graze the range properly.

This section discusses the use of the soils for irrigated and dryland crops, for range, for wildlife, and for engineering purposes.

Dryland and Irrigated Crops

This subsection suggests management for irrigated and nonirrigated cropland in Moore County. First, the system of land capability classification used by the Soil Conservation Service is briefly explained, and then management is suggested for the nonirrigated and irrigated capability units in Moore County. Finally, yields of selected crops under a high level of management are predicted for soils commonly cropped in the county.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range or for engineering.

In the capability system, the soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numer-

als indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, range, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes. (None in Moore County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in Moore County but not in all parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c* because the soils in class V are subject to little or no erosion. though they have other limitations that restrict their use largely to pasture, range, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example IIIe-4 or IVw-7. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management of the soils by capability units [2]

This subsection describes the soils in each capability unit, tells of their suitability for crops and range, and discusses management practices. In Texas, capability units are numbered according to a Statewide system of capability classification. Not all the capability units in this system are represented in Moore County. For this reason not all the unit numbers are consecutive in this survey.

CAPABILITY UNIT I-1, IRRIGATED

Harney clay loam, 0 to 1 percent slopes, is the only soil in this unit. This soil is deep and moderately slowly permeable.

Wheat, sorghum, corn, and soybeans are grown in most cropping systems used on this soil.

Management of crop residue, use of fertilizer, and proper application of irrigation water help to maintain tilth and to control erosion.

CAPABILITY UNIT I-2, IRRIGATED

The soils in this unit are nearly level to gently sloping loams and clay loams. These soils are deep and moderately permeable.

Wheat and sorghum are the main crops.

Keeping crop residue on the surface, using fertilizer, and carefully managing irrigation water help to maintain tilth and to control erosion.

CAPABILITY UNIT IIe-1, IRRIGATED

In this unit are loams and clay loams. These soils are deep and moderately permeable.

The main crops are wheat and grain sorghum.

Use of fertilizer, rotation of crops, management of crop residue, and controlled application of irrigation water in a properly designed irrigation system are major needs. Diversion terraces and grassed waterways to control excess water are needed in some areas.

CAPABILITY UNIT IIe-2, IRRIGATED

Harney clay loam, 1 to 3 percent slopes, is the only soil in this unit. This soil is deep and moderately slowly permeable. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

The main crops are wheat and sorghum.

Using fertilizer, rotating crops, managing residue to improve and protect the soil, and controlling the application of irrigation water by a properly designed irrigation system are necessary. Excess water can be controlled by diversions and grassed waterways.

CAPABILITY UNIT IIe-3, IRRIGATED

Sunray loam, 0 to 1 percent slopes, is the only soil in this unit. This soil is deep and moderately permeable. The hazard of water erosion is slight, and the hazard of soil blowing is moderate. Yellowing of sorghum because of iron deficiency may be a concern.

The main crops are wheat and grain sorghum. Some forage crops, such as corn, silage sorghum, and alfalfa, are also grown.

Use of fertilizer, management of residue, rotation of crops, and management of irrigation water in a properly

[2] By ALLEN H. KING, conservation agronomist, Soil Conservation Service, Amarillo, Texas.

planned irrigation system are needed to control soil blowing and to maintain tilth.

CAPABILITY UNIT IIe–4, IRRIGATED

Dalhart fine sandy loam, 0 to 1 percent slopes, is the only soil in this unit. This soil is deep and moderately permeable. The hazard of soil blowing is moderate.

Wheat and grain sorghum are the main crops. Some forage crops are also grown.

Use of fertilizer, rotation of crops, timely tillage, management of residue for soil protection and improvement, and proper irrigation are necessary. Sprinkler irrigation, as well as gravity irrigation, is suited.

CAPABILITY UNIT IIe–6 IRRIGATED

Dalhart fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. This soil is deep and moderately permeable. The hazards of water erosion and soil blowing are moderate.

The main crops are wheat and grain sorghum. Forage crops are sometimes grown.

Some areas need erosion control, such as management of residue-producing crops, timely tillage, terraces or diversions, and properly planned irrigation systems. Rotation of crops, use of fertilizer, and management of irrigation water help to maintain tilth.

CAPABILITY UNIT IIs–1, IRRIGATED

Sherm silty clay loam, 0 to 1 percent slopes, is the only soil in this unit. This soil is deep and very slowly permeable.

Such crops as wheat, grain sorghum, soybeans, and forage are grown.

Applying fertilizer and returning a large amount of residue to the soil help to maintain tilth. A properly designed irrigation system is needed. (fig. 9). Good recovery systems for irrigation runoff are generally useful. Some areas need waterways and diversion terraces that remove excess water safely.

CAPABILITY UNIT IIIce–1, DRYLAND

Sherm silty clay loam, 0 to 1 percent slopes, is the only soil in this unit. This soil is deep and very slowly permeable.

The main crops are wheat, grain, and forage sorghum.

Management is needed that includes protection from soil blowing by use of crop residue, timely but limited tillage, and use of diversion terraces and grassed waterways where excess runoff is a concern.

CAPABILITY UNIT IIIce–2, DRYLAND

In this unit are nearly level loams and clay loams. These soils are moderately permeable to moderately slowly permeable. The hazard of water erosion is slight, and the hazard of soil blowing is slight to moderate.

The main crops are wheat, grain, and forage sorghum.

Management is needed that leaves residue on the surface to control soil blowing and water erosion and to help to maintain tilth. Timely and limited tillage and use of terraces, diversions, and grassed waterways are also needed.

CAPABILITY UNIT IIIce–3, DRYLAND

Sunray loam, 0 to 1 percent slopes, is the only soil in this unit. This soil is deep and moderately permeable.

Figure 9.—A graded-furrow surface irrigation system used to irrigate wheat on a Sherm silty clay loam.

The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Sorghum and wheat are the main crops.

Control of soil blowing by residue management and timely and limited tillage is needed. In some areas diversion terraces and waterways are needed to remove excess water.

CAPABILITY UNIT IIIe-1, DRYLAND

Sherm silty clay loam, 1 to 3 percent slopes, is the only soil in this unit. The soil is deep, fertile, and very slowly permeable. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

The main crops grown on this soil are sorghum and wheat for grain and forage.

Practices that help to protect this soil from blowing and water erosion and help to maintain tilth are crop residue management, terracing, contour farming, and limited and timely tillage. Diversion terraces and waterways are useful in controlling runoff.

CAPABILITY UNIT IIIe-1, IRRIGATED

Sherm silty clay loam, 1 to 3 percent slopes, is the only soil in this unit. This soil is deep and very slowly permeable. Water erosion is moderate. The hazard of soil blowing is slight.

Wheat, sorghum, corn, and forage are the main crops.

Applying fertilizer and returning a large amount of crop residue help to maintain soil tilth. A properly designed irrigation system is needed. Systems for recovering runoff irrigation water are useful. Some areas need grassed waterways and diversion terraces that remove excess water safely.

CAPABILITY UNIT IIIe-2, DRYLAND

The soils in this unit are deep and have a loam or clay loam surface layer. They are nearly level to gently sloping. Permeability is moderate to moderately slow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight to moderate.

Wheat and sorghum for grain and forage are the main crops grown on these soils.

Use of residue and proper management of crops help to control water erosion and soil blowing. Contour farming and terracing also help to reduce water erosion. In some places diversion terraces and waterways are needed to remove excess runoff safely.

CAPABILITY UNIT IIIe-2, IRRIGATED

The soils in this unit have a loam surface layer. They are deep, gently sloping, and moderately permeable. The hazard of water erosion is moderate to severe.

Wheat and sorghum for grain and grazing are the main crops.

Using a properly designed irrigation system, growing high-residue crops, properly managing residue, and reducing tillage help to control erosion. In addition, some areas need waterways, diversion terraces, or other terraces. Fertilizer is also needed.

CAPABILITY UNIT IIIe-3, DRYLAND

Sunray loam, 1 to 3 percent slopes, is the only soil in this unit. This soil is deep and moderately permeable. The hazards of water erosion and soil blowing are moderate.

Sorghum and wheat are the main crops.

Crops such as wheat and sorghum grown in rotation, residue management, timely tillage, contour farming, and terracing help to control water erosion and soil blowing. Diversion terraces and waterways are useful in disposing of excess rainfall.

CAPABILITY UNIT IIIe-4, DRYLAND

In this unit are nearly level to gently sloping soils that have a fine sandy loam surface layer. These soils are deep and moderately permeable. The hazard of water erosion is slight to moderate, and the hazard of soil blowing is moderate.

Crops include wheat, grain sorghum, and forage sorghum. Some of the wheat is pastured.

Good management includes leaving residue on the surface when crops are not being grown, timely and limited tillage, and rotation of crops. Some areas need contour farming and terraces to control erosion. Some areas need diversion terraces and waterways to remove excess water.

CAPABILITY UNIT IIIe-4, IRRIGATED

Sunray loam, 1 to 3 percent slopes, is the only soil in this unit. This soil is deep and moderately permeable. The hazards of water erosion and soil blowing are moderate.

Alfalfa is grown, and so are sorghum and wheat for grain and grazing.

Use of fertilizer, management of residue, rotation of crops, timely and limited tillage, and management of irrigation water in a properly planned irrigation system help to control water erosion and soil blowing. In some areas diversion terraces, terraces, and grassed waterways are needed to control excess water.

CAPABILITY UNIT IIIe-6, DRYLAND

Mobeetie fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. This soil is deep, calcareous, and moderately rapidly permeable. The hazards of water erosion and soil blowing are moderate.

Small grain, perennial grasses, and forage sorghum are suited to this soil.

This soil can be protected from erosion by using a cropping system that includes small grain, forage crops, and perennial grasses, and by carefully managing residue in a timely tillage sequence. Contour farming and terracing also help to control water erosion. In some areas grassed waterways and diversion terraces are needed to control excess runoff or water from adjacent slopes.

CAPABILITY UNIT IIIe-6, IRRIGATED

Mobeetie fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. This soil is deep, calcareous, and moderately rapidly permeable. The hazards of water erosion and soil blowing are moderate.

Small grain, forage sorghum, alfalfa, and perennial grasses grown in rotation are suited to this soil.

This soil needs the protection of residue and growing crops in a well-managed cropping system. Tillage should be done at the right time and in the right way. Properly planned irrigation systems are needed, and sprinkler systems are suited. Some areas need diversions, terraces,

and grassed waterways to control erosion by excess runoff or by water from adjacent slopes.

CAPABILITY UNIT IIIe–10, IRRIGATED

In this unit are nearly level to gently sloping, calcareous fine sandy loams and loams. These soils are moderately permeable. The hazard of water erosion is moderate, and the hazard of soil blowing is moderate to severe.

Small grain and sorghum for grain and grazing are grown.

The soils in this unit need the cover and residue from such crops as small grain and sorghum, which help control water erosion and soil blowing. Fertilizer is needed to maintain soil fertility. A properly designed irrigation system helps to control erosion and to meet crop needs. Some areas need other erosion control measures, such as terraces, diversion terraces, and grassed waterways.

CAPABILITY UNIT IIIs–1, IRRIGATED

Ness clay (drained) is the only soil in this unit. This soil is very slowly permeable. Soil blowing, surface drainage, and a tendency to crack are limitations.

The main crops are grain and forage sorghum.

Keeping residue on the surface helps to control soil blowing. Maintaining a plant cover and controlling the moisture content of the soil alleviates but does not eliminate deep cracking of the soil. Fertilizers and a properly designed irrigation system are needed. Ditches, levees, terraces, or similar structures are needed to control water from adjacent slopes.

CAPABILITY UNIT IVe–1, DRYLAND

In this unit are gently sloping soils that have a loam surface layer. These soils are deep and moderately permeable. The hazard of water erosion is moderate to severe.

The main crops are wheat and sorghum.

Keeping crop residue on the surface helps to protect the soil during critical periods of erosion. In some areas contour farming, terraces, diversions, and grassed waterways are needed to help control erosion.

CAPABILITY UNIT IVe–2, DRYLAND

In this unit are gently sloping, calcareous soils that have a loam surface layer. These soils are moderately permeable. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Small grain and sorghum for grain and grazing are the main crops.

Growing such crops as small grain and sorghum and using residue-conserving tillage, contour farming, and terracing help to control erosion. In some areas diversions and waterways are needed to remove excess water.

CAPABILITY UNIT IVe–2, IRRIGATED

In this unit are gently sloping fine sandy loams. These soils are deep and moderately permeable to moderately rapidly permeable. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Small grain, sorghum, alfalfa, and perennial grasses grown in rotation are suitable crops.

These soils require crops that produce cover and residue sufficient to protect the soil and maintain tilth. Fertilizers and the use of irrigation water in a properly designed sprinkler system are needed. Contour farming and terracing are needed to protect the soil from erosion. In some areas grassed waterways and diversions are needed to control runoff.

CAPABILITY UNIT IVe–4, DRYLAND

Dalhart fine sandy loam, 3 to 5 percent slopes, is the only soil in this unit. This soil is deep and moderately permeable. The hazard of water erosion is severe.

Wheat, grain, and forage sorghum are among the crops grown.

CAPABILITY UNIT IVe–5, DRYLAND

Mobeetie fine sandy loam, 3 to 5 percent slopes, is the only soil in this unit. This soil is deep and moderately rapidly permeable. The hazard of soil blowing is moderate.

Forage crops of small grain, sorghum, and perennial grasses are suited to this soil.

Using drilled residue-producing crops and keeping crop residue on the surface are ways to protect the soil from blowing and water erosion. Diversion terraces and grassed waterways control excess runoff and water from adjacent slopes.

CAPABILITY UNIT IVe–6, IRRIGATED

Conlen loam, 3 to 5 percent slopes, is the only soil in this unit. This soil is calcareous and moderately permeable. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Small grain, sorghum for grain and forage, and other forage crops such as alfalfa are suited to this soil.

Continuous residue-producing crops and protective crops should be grown on this soil. Limited tillage, including stubble mulching, reduces erosion by conserving residue. A sprinkler system of irrigation is suited to this soil. Terracing and contour farming help to control water erosion. Some areas need grassed waterways and diversions.

CAPABILITY UNIT IVe–9, DRYLAND

The soils in this unit are nearly level to gently sloping. They have a calcareous loam surface layer and are moderately permeable. The hazards of water erosion and soil blowing are moderate.

The main crops are small grain and sorghum.

Using protective residue, limiting tillage, farming on the contour, and terracing help to control soil blowing and water erosion. In some areas diversion terraces and waterways are needed to control runoff from adjacent slopes.

CAPABILITY UNIT IVe–10, DRYLAND

Veal fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. This soil is deep, calcareous, and moderately permeable. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Small grain and sorghum for grain and grazing are the main crops.

Growing protective-residue-producing crops, using residue management and limited tillage, and contour farming and terracing are needed practices for protecting this soil. Diversion terraces and waterways to carry off excess water may be needed to control outside water.

CAPABILITY UNIT IVs–1, DRYLAND

Ness clay (drained) is the only soil in this unit. This soil is deep and very slowly permeable. The hazard of soil blowing is moderate.

Grain and forage sorghum are grown.

Smoothing or leveling the surface, controlling outside water, limiting tillage, and conserving residue are needed practices.

CAPABILITY UNIT Vw–1, DRYLAND

The soils in this unit are calcareous fine sandy loams to loams. These soils are deep and moderately permeable to moderately rapidly permeable. They are subject to occasional overflow.

These soils are used for perennial grasses.

Grazing management is needed to maintain the perennial grasses and to provide cover for the control of erosion. Some areas need brush control.

CAPABILITY UNIT Vw–2, DRYLAND

Lincoln loamy fine sand is the only soil in this unit. This is a deep, sandy alluvial soil that is subject to overflow. It is rapidly permeable. The hazard of soil blowing is severe.

This soil is used for perennial native plants.

Grazing management is needed to control erosion and to maintain a grass cover. Some areas need brush control.

CAPABILITY UNIT VIe–1, DRYLAND

The soils in this unit are gently sloping to sloping and very slowly permeable to moderately permeable. The hazards of water erosion and soil blowing are moderate to severe.

Grazing management is needed to maintain the grass cover and to control water erosion and soil blowing. Some areas need brush control. Some trails and roads need to be relocated, or they need small dams or dikes that break up concentrations of water and carry it to one side.

CAPABILITY UNIT VIe–2, DRYLAND

The soils in this unit are gently sloping to strongly sloping and very shallow to deep. The hazards of water erosion and soil blowing are moderate to severe.

Grazing management is needed to maintain grass cover and to control soil blowing and water erosion. Some areas need brush control.

CAPABILITY UNIT VIe–5, DRYLAND

In this unit are hummocky and undulating, sandy soils. These soils are deep and moderately rapidly permeable. The hazards of water erosion and soil blowing are severe.

Grazing management that maintains the vigor of plants and insures a good cover of grasses is needed to control soil blowing and water erosion. In some areas competing vegetation requires control.

CAPABILITY UNIT VIw–1, DRYLAND

Ness clay (undrained) is the only soil in this unit. This soil is deep and very slowly permeable. It is on old lakebeds and is subject to long periods of inundation followed by periods of drying. The hazard of soil blowing is moderate.

Management that maintains grass cover and controls soil blowing is needed.

CAPABILITY UNIT VIIe–1, DRYLAND

Tivoli fine sand, hummocky, is the only soil in this unit. This soil is deep and rapidly permeable. The hazard of soil blowing is severe.

Grazing management is needed to maintain a grass cover and to control soil blowing.

CAPABILITY UNIT VIIs–1, DRYLAND

In this unit are very shallow to shallow, limy, gently sloping to steep, gravelly soils. The hazard of erosion is moderate to severe.

Grazing management is needed to maintain a grass cover and to control erosion.

CAPABILITY UNIT VIIs–2, DRYLAND

This unit consists only of Rough broken land. This miscellaneous land type is made up of escarpments, bluffs, canyons, and foot slopes.

Grazing management and careful location of fences, roads, and watering facilities are needed to maintain a grass cover and to control erosion.

CAPABILITY UNIT VIIs–3, DRYLAND

The soils in this unit are gravelly, gently sloping to steep, and shallow to moderately deep to soft caliche. They are moderately permeable. The hazards of water erosion and soil blowing are slight.

Grazing management is needed to maintain a grass cover and to control erosion.

Predicted yields

Estimated yields are shown in table 2 for each soil in Moore County that is commonly used for crops. Yields are provided only for a high level of management. This level of management includes the better soil, plant, and water management practices.

The main practices for dryland crops under a high level of management are—

1. Conserving precipitation.
2. Rotating crops; alternating close-growing and soil-protecting crops with clean-tilled crops.
3. Leaving crop residue on the surface of the soil at least during critical erosion periods.
4. Tilling the soil at the right time and keeping tillage to a minimum.
5. Using terraces, diversions, and grassed waterways where needed and following terraces and guidelines in contour farming.

The main practices for irrigated crops under a high level of management are—

1. Conserving precipitation.
2. Rotating crops; alternating soil-protecting and soil-improving crops with clean-tilled crops.
3. Fertilizing to meet crop needs.
4. Leaving crop residue on or near the surface during critical erosion periods.
5. Tilling the soil at the right time and keeping tillage to a minimum.

TABLE 2.—*Predicted average yields per acre of principal dryland and irrigated crops*

[A dash in the column indicates that the crop is generally not grown on the soil. Only the soils commonly used for crops are listed in this table]

Soil	Wheat		Grain sorghum		Forage sorghum	Alfalfa
	Dryland	Irrigated	Dryland	Irrigated	Irrigated	Irrigated
	Bu.	*Bu.*	*Lbs.*	*Lbs.*	*Tons*	*Tons*
Capps clay loam, 0 to 1 percent slopes	12	55	1,000	6,700	22	5.0
Capps clay loam, 1 to 3 percent slopes	10	50	900	5,500	16	4.5
Conlen loam, 0 to 1 percent slopes	8	37	700	4,000	16	3.5
Conlen loam, 1 to 3 percent slopes	8	37	700	4,000	16	3.5
Conlen loam, 3 to 5 percent slopes	7		500			
Dalhart fine sandy loam, 0 to 1 percent slopes	10	50	950	6,000	18	5.0
Dalhart fine sandy loam, 1 to 3 percent slopes	10	50	900	5,900	16	5.0
Dalhart fine sandy loam, 3 to 5 percent slopes	8		650			
Dumas loam, 0 to 1 percent slopes	13	55	1,000	6,700	22	5.0
Dumas loam, 1 to 3 percent slopes	11	50	900	5,500	16	4.5
Dumas loam, 3 to 5 percent slopes	8		700			
Harney clay loam, 0 to 1 percent slopes	12	55	950	6,700	22	5.0
Harney clay loam, 1 to 3 percent slopes	10	45	800	5,500	16	4.5
Manzano clay loam, 1 to 3 percent slopes	13	50	800	5,500	16	5.0
Mobeetie fine sandy loam, 1 to 3 percent slopes	8		800			
Mobeetie fine sandy loam, 3 to 5 percent slopes	6		650			
Sherm silty clay loam, 0 to 1 percent slopes	11	55	800	6,500	22	5.0
Sherm silty clay loam, 1 to 3 percent slopes	10	45	700	5,500	16	4.5
Sunray loam, 0 to 1 percent slopes	10	45	800	5,000	17	5.0
Sunray loam, 1 to 3 percent slopes	9	40	600	4,500	15	4.5
Ulysses-Sunray complex, 3 to 5 percent slopes	7		500			3.5
Veal fine sandy loam, 1 to 3 percent slopes	8		700			3.5

6. Installing a system to use irrigation water efficiently without waste or erosion.
7. Applying irrigation water according to needs indicated by soil characteristics and crop growth requirements.

Range [3]

Ranching is one of the most important enterprises in Moore County. Native grassland covers about 54 percent of the county. There are 35 ranching units in the county, and they range from 700 to 50,000 acres in size. The southeastern quarter of the county is all rangeland and makes up 80 percent of the range in the county. Grass production is normally good.

Most landowners prefer to lease out their grassland and seldom operate the ranch themselves.

Livestock operations are primarily of the cow-calf type on all bona fide ranching units. Cropland is used primarily for cash crops; however, several thousand head of stocker cattle are brought in each year to graze wheat fields. These cattle are shipped in beginning in mid-September and are sent to market by March 15 to permit wheat to mature and make a grain crop.

A trend that has developed in recent years is for stockmen to purchase irrigated wheat crops and graze stocker cattle on them. Although the cost per acre appears to be high, up to five stockers per acre can be safely grazed during April and May.

Another trend that has developed recently is the establishment of feedlots, which have a capacity of 15,000 to 35,000 head. About 125,000 animals are fed out each year in Moore County. Most of these operations use locally produced feedstuffs, including corn silage and corn and milo grain.

The cold winters in Moore County severely hamper cattle operations. Ranchers must break ice frequently to provide water for cattle. Most of this water supply is pumped by windmills. Supplemental feeding begins early in winter and extends late into spring. Usually, only protein concentrates are fed; hay is sometimes fed.

The ranch country is primarily in an area of sandy and loamy soils. Most of these soils are gently sloping to steep and are dissected by distinct drainage nets.

The native grasslands in this county have been heavily grazed for several generations. The more desirable grasses and forbs have been grazed out, and many kinds of less desirable grasses dominate. Sand sage and yucca are the most significant undesirable plants.

Although these grasslands have been abused in the past, there is still a seed source of the more desirable species. The only areas of native grassland that require reseeding are those that have been disturbed mechanically by installation of pipelines, electrical highlines, and natural gas industrial works. Grassland management, rather than grassland restoration, is generally the key to improvement.

Another problem common to the area is cattle trails leading to watering facilities, which etch deep, narrow gullies. Because of the topography, windmills are located either on top of the hills or in the valleys. This contributes to the problem of trailing by livestock.

[3] By JOHN A. WRIGHT, range conservationist, Soil Conservation Service.

Range sites and condition classes

A range site is a distinctive kind of range that differs from other kinds of range in its potential for producing native plants. Range sites differ in ability to produce significantly different kinds or proportions of plants or in total annual production. Significant differences are those great enough to require some variation in management, such as a different stocking rate.

Differences in kind, proportion, and production of plants on different sites are due in large measure to differences in factors such as soil, topography, and climate. Therefore, range sites can be identified by the kinds of soil known to be capable of producing the distinctive climax community, or potential plant community, that characterizes each site.

Most of the native grassland of Moore County has been heavily grazed for several generations, and its original plant cover has been materially altered. Range condition is the present state of the vegetation of a range site in relation to the potential plant cover for that site. The range condition class indicates the degree to which the present plant composition, expressed as a percentage, resembles that of the climax community of the range site. The four range condition classes recognized are: excellent (76 to 100 percent of the potential composition is present), good (51 to 75 percent), fair (26 to 50 percent), and poor (0 to 25 percent).

In determining present range condition class, plants are grouped according to their response to grazing. Some species in the climax community decrease in relative abundance when the community is subjected to continued moderately heavy to heavy grazing. Most of these plants are preferred by cattle. The present total of all such species is counted in determining range condition class.

Other species in the climax community normally increase in relative abundance when the community is subjected to continued moderately heavy to heavy grazing. Some of these that are moderately preferred by cattle may initially increase, and then decrease as grazing pressure continues. Others, not preferred, may continue to increase either in actual plant numbers or in relative proportions. Only the percentages of such plants normally in the climax community are counted in determining range condition.

Plants of a third type are not members of the climax community of the site. They invade the community as a result of various kinds of disturbance. They may be annuals or perennials and may be grasses, weeds, or woody plants. Some have relatively high grazing value, but many are worthless in that they provide very little forage and compete with the more desirable plants for sunlight, moisture, and nutrients. These plants are not counted in determining range condition class.

For most range sites and most range livestock operations, the better the range condition class, the greater the quality and amount of available forage.

Descriptions of range sites

Thirteen range sites have been identified in Moore County. They are described in the following pages.

525-893—75——3

DEEP HARDLAND RANGE SITE

This site consists mostly of smooth, nearly level to steep loams. These soils are deep, are moderately permeable to very slowly permeable, and have high available water capacity. In many places moisture intake has been reduced by surface crusting and by a hoof pan caused by trampling. This site is accessible to livestock and is favored for grazing.

The potential plant community consists of short grasses. Blue grama makes up about 70 percent of the original plant community. Other species that occur in limited amounts are western wheatgrass, vine-mesquite, feather bluestem, buffalograss, tobosagrass, and sand dropseed.

Continuous overgrazing of this site results in an immediate decrease in blue grama and an increase in buffalograss. Further deterioration of the range results in invasion by perennial three-awn, hairy tridens, broom snakeweed, and mesquite.

Where this site is in lower condition class, and during years that have a wet spring, invading annuals occupy the bare spots. The most common of these are Texas filaree, evax, various plaintains, bladderpod, plains greenthread, bitterweed actinea, common broomweed, and little barley. The common invading perennial forbs on this site are western ragweed, silverleaf nightshade, and Dakota verbena.

A plant cover is necessary on this site to reduce surface crusting and to prevent erosion. Once the range is in poor condition, recovery is very slow because of crusting, infestation by mesquite, and a lack of seed plants of desirable species. Through good management, this site can be brought back to its original condition.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 1,300 pounds to 2,100 pounds per acre.

DEEP SAND RANGE SITE

Tivoli fine sand, hummocky, is the only soil in this site. This soil is deep, hummocky (fig. 10), and rapidly permeable. The hazard of soil blowing is severe. Many areas appear to be stabilized dunes.

Figure 10.—Tivoli fine sand, hummocky, in Deep Sand range site.

The vegetation is predominantly tall grasses and includes smaller amounts of mid grasses. Among the grass species that make up 70 percent of the original plant community are sand bluestem, little bluestem, sand dropseed, and perennial three-awn. Some woody plants, such as Havard oak, are also present.

This site deteriorates rapidly under continued heavy grazing, but it responds favorably to good management.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 1,200 pounds to 3,200 pounds per acre.

GRAVELLY RANGE SITE

The soils in this unit are gently sloping to steep, gravelly, and shallow to moderately deep to soft caliche. These soils are on ridges, knolls, and hills (fig. 11). The hazards of water erosion and soil blowing are slight.

The climax vegetation is bunch grasses. Where the site is in excellent condition, about 80 percent of the vegetation is little bluestem and side-oats grama. Silver bluestem and hairy grama make up about 15 percent of the climax community. Woody plants, such as redberry juniper, catclaw, and yucca, are also present in places.

Where the range is in fair to poor condition, three-awn and hairy tridens invade.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 600 pounds to 1,500 pounds per acre.

HARDLAND SLOPES RANGE SITE

The soils in this site are nearly level to gently sloping. They are moderately permeable. The hazards of water erosion and soil blowing are moderate to severe.

On this site the important grasses are side-oats grama and blue grama. If grazing is heavy, blue grama, buffalograss, and other grasses replace side-oats grama. A thinning of side-oats grama indicates that the site is overgrazed. Western ragweed, pricklypear, cactus, small soapweed, and broom snakeweed are invading species.

Under moderately heavy grazing this site maintains a good cover. Response to management is good. Maximum production is obtained if the site is managed so that side-oats grama is maintained. Most areas of this site are kept in good condition, and blue grama and moderate amounts of side-oats grama dominate.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 1,300 to 2,100 pounds per acre.

LOAMY BOTTOMLAND RANGE SITE

In this site are nearly level loams on flood plains. These soils are deep and moderately permeable to moderately rapidly permeable. Available water capacity is moderate to high. The soils of this site receive runoff from adjacent areas. If not protected by a plant cover, they are subject to scouring, flooding, and, in some areas, deposition. The soils of this site support an excellent growth of plants.

Figure 11.—Tascosa gravelly soils, hilly, in Gravelly range site.

The composition of the climax community varies from place to place, depending on the texture of the alluvial deposits. About 70 percent is big bluestem, sand bluestem, little bluestem, indiangrass, switchgrass, Canada wildrye, and side-oats grama. Western wheatgrass, vine-mesquite, silver bluestem, blue grama, and buffalograss make up the remaining 30 percent. A few woody plants, chiefly elm, hackberry, and cottonwood, are in the climax community on some bottom lands.

If the climax vegetation is not maintained, the site is invaded by noxious plants, the seed of which wash in from outlying areas. These invaders, ordinarily annuals that are common in cultivated fields, include sunflower, cocklebur, buffalo-bur, hairy caltrop, common broomweed, croton, thistle, and sandbur. Other common invading species are sand dropseed, three-awn, windmillgrass, hairy tridens, and perennial forbs.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 2,100 pounds to 3,800 pounds per acre.

MIXEDLAND RANGE SITE

Enterprise very fine sandy loam, 5 to 8 percent slopes, is the only soil in this site. This soil is deep and moderately rapidly permeable.

The dominant grasses are blue grama, side-oats grama, vine-mesquite, and western wheatgrass. Other grasses are buffalograss and silver bluestem.

Invading species are commonly three-awn, sand dropseed, western ragweed, broom snakeweed, mesquite, and small soapweed.

This site is easy to overgraze, because it is much easier for livestock to graze on it than in the adjoining rough and broken areas. A good plant cover is necessary to prevent water erosion. The present vegetation is mainly blue grama, dropseed, scattered mesquite, and a few junipers. By good management, this site can be brought back to its original productive condition.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 1,200 pounds to 2,500 pounds per acre.

MIXEDLAND SLOPES RANGE SITE

In this site are gently sloping to strongly sloping loams (fig. 12). These soils are deep and moderately rapidly permeable to moderately permeable. The hazards of water erosion and soil blowing are moderate to severe.

Mid grasses mostly dominate, but traces of side-oats grama, little bluestem, sand bluestem, and other tall

Figure 12.—Area of Mobeetie, Veal, and Pastura soils in Mixedland Slopes range site.

grasses are in most areas. Other grasses are blue grama, buffalograss, three-awn, and hairy grama.

Invading species are mainly western ragweed, yucca, and annual weeds and grasses.

Most areas have mixtures of side-oats grama, blue grama, and scattered yucca plants. In a few areas sagebrush grows and is becoming thicker under yucca control and good management. A few scattered mesquite plants are present in places.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 1,200 pounds to 2,500 pounds per acre.

ROUGH BREAKS RANGE SITE

This site consists only of Rough broken land. It is made up of steep, stony or gravelly areas, canyon walls, bluffs, and gullied areas (fig. 13). The areas are limestone, caliche, and spots of shallow soils on mesas and foot slopes. Some of the areas are not accessible to livestock.

The vegetation on this site is predominantly mid grasses, but small amounts of tall and short grasses also grow. The climax vegetation is chiefly side-oats grama, little bluestem, and blue grama, Switchgrass, sand bluestem, indiangrass, and Canada wildrye grow in places that have more favorable moisture conditions. Other plants, making up 30 percent of the original plant community, are hairy grama, perennial three-awn, slim tridens, and sand dropseed. Woody species on the slopes are redberry juniper, feather dalea, skunkbush, and catclaw acacia.

Invading species on the site are hairy tridens, sand muhly, and annuals.

Under prolonged heavy use, these steep slopes lose their protective plant cover and erosion is highly accelerated. Under such conditions soil loss is severe. Intensive management and protection must be applied to stabilize the areas of soil. The total potential production of this site is negligible as compared to surrounding sites. Consequently, grazing a pasture in a manner that deteriorates this site results in very severe deterioration of the entire pasture.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 550 pounds to 950 pounds per acre. About 95 percent of this production is suitable forage for cattle.

SANDY BOTTOMLAND RANGE SITE

Lincoln loamy fine sand is the only soil in this site. This is a deep, nearly level, rapidly permeable soil on flood plains. Available water capacity is low. The hazard of soil blowing is severe. This soil receives runoff from adjacent areas, and it is subject to scouring.

The vegetation is mainly mid and tall grasses. Indiangrass, switchgrass, and sand bluestem dominate where the site is in its original condition. Other grasses present are side-oats grama, little bluestem, Canada wildrye, Texas bluegrass, and big sandreed. About 70

Figure 13.—Area of Rough broken land in Rough Breaks range site.

percent of the original plant community is these species. A few woody plants, such as sand plum, cottonwood, black locust, Chinese elm, hackberry, willow, sand sagebrush, and skunkbush, are present where the site is in climax condition.

Overgrazing results in a rapid increase of such grasses as vine-mesquite, three-awn, sand dropseed, and blue grama. Further degeneration in the plant stand results in an invasion of gummy lovegrass, annual three-awn, tumble lovegrass, low-growing paspalums, numerous annuals, yuca, and groundsel.

Once the climax vegetation is grazed out, the productivity of the site declines immediately. The growth of plants is generally excellent on this site.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 2,100 pounds to 3,700 pounds per acre.

SANDYLAND RANGE SITE

In this site are deep, undulating to hummocky soils that have a surface layer of loamy fine sand. These soils are moderately rapidly permeable and have low to moderate available water capacity. The hazards of water erosion and soil blowing are severe.

About 75 percent of the plant community on this site is sand bluestem, switchgrass, indiangrass, little bluestem, Canada wildrye, sand lovegrass, side-oats grama, and Texas bluegrass. About 25 percent is silver bluestem, sand dropseed, hairy grama, blue grama, and perennial three-awn. In some areas of this site, a few woody plants, such as sand plum and sand sagebrush, are present in the climax community.

Any deterioration of this site results in a rapid increase of small soapweed and annuals. Invading grasses include annual three-awn, fringed signalgrass, tumble windmillgrass, gummy lovegrass, red lovegrass, tumble lovegrass, and low-growing paspalums. The chief invading forbs are common ragweed, wax goldenweed, tumble ringwing, annual wild buckwheat, rose-ring gaillardia, prairie sunflower, woolywhite, beebalm, pricklepoppy, curlycup gumweed, Riddle groundsel, and stillingia.

This site is capable of high production of mid and tall grasses if it is maintained in good or excellent condition. Because there are few intermediate grasses for grazing, production drops rapidly when the vegetation is overgrazed. Recovery is rapid, however, if brush is controlled and grazing is deferred.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 1,800 pounds to 3,350 pounds per acre.

SANDY LOAM RANGE SITE

The soils in this site are nearly level to sloping. They have a fine sandy loam surface layer and are moderately permeable to moderately rapidly permeable. The hazard of water erosion is slight to severe, and the hazard of soil blowing is moderate to severe.

Grasses are mainly side-oats grama, but traces of little bluestem are present. Yucca and sand sagebrush are scattered throughout most areas.

In overgrazed areas blue grama and buffalograss thicken and dominate. If abuse of the range continues, broom snakeweed, western ragweed, mesquite, cactus, and other plants take over.

Some areas require control of yucca and sand sagebrush.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 1,600 pounds to 2,500 pounds per acre.

SHALLOW REDLAND RANGE SITE

Vernon clay loam, 3 to 8 percent slopes, is the only soil in this site.

The dominant grasses are blue grama, side-oats grama, and little bluestem. Other grasses are galleta, black grama, hairy grama, and three-awn.

Redberry juniper, catclaw, hairy grama, and hairy tridens are invading species.

Careful management is needed to prevent overgrazing. Recovery is slow even under good management.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 400 pounds to 800 pounds per acre.

VERY SHALLOW RANGE SITE

The soils in this site are gently sloping to steep, very shallow to shallow gravelly loams.

Vegetation on this site is mid grasses, and side-oats grama dominates. Other grasses are blue grama and little bluestem. On the northern slopes and in places where moisture is more favorable are sand bluestem, indiangrass, vine-mesquite, and plains bristlegrass. Other grasses are hairy grama, black grama, buffalograss, silver bluestem, and dropseed, perennial three-awn, slim tridens, and rough tridens.

Invading species are hairy tridens, sand muhly, tumblegrass, mesquite, pricklypear, yucca, annuals and redberry juniper.

Where this site is in excellent condition, the total annual production of air-dry herbage ranges from 850 pounds to 1,750 pounds per acre.

Wildlife [4]

Most of the soils in Moore County are suited to, and support, one or more species of wildlife. The early settlers found antelope, buffalo, prairie chicken, and quail abundant in Moore County. Deer, turkey, and squirrel were plentiful along the wooded streams. After livestock was introduced, overgrazing, fencing, and cultivation limited the number of antelope, deer, squirrel, turkey, and prairie chicken. Buffalo and prairie dogs also declined before civilization.

Many quail, dove, songbirds, small mammals, and predators still inhabit the county. The streams, ponds, playa lakes and grain fields attract migrating ducks and geese. Fish are limited to artificial impoundments, such as Lake Meredith and ponds on farms and ranches.

Every year more people look to the land for recreation. Hunting and fishing become more important each year. The country has potential for economic return derived through development of hunting, fishing, and recreation areas.

The soil associations of Moore County have been placed in two wildlife sites. Each site is unique in

[4] By John A. Wright, range conservationist, Soil Conservation Service.

topography, productivity, kinds and amounts of vegetation, and principal species of wildlife. The soil associations are shown on the general soil map at the back of this survey and are described in the section "General Soil Map."

The first wildlife site consists of nearly level to gently sloping soils. In this site are the Sherm, Sunray, Dumas-Dalhart, and Sunray-Ulysses-Humbarger associations.

Most areas of these soils are cultivated. In areas that are not cultivated, the vegetation is mainly buffalograss, blue grama, western wheatgrass, and associated legumes and forbs. The principal animals in this site are antelope, badger, coyote, and rabbit; birds are dove, ducks, geese, quail, and songbirds.

The second wildlife site consists of gently sloping to very steep soils cut by intermittent streams. In this site are the Mobeetie-Tascosa-Pastura, Likes-Springer-Tivoli, and Rough broken land associations.

The grasses range from short to tall and are primarily buffalograss, blue grama, side-oats grama, little bluestem, sand bluestem, switchgrass, and indiangrass. Also present are associated legumes and forbs. A few scattered trees, such as Chinese elm, black locust, mesquite, and hackberry, grow on upland soils; redberry juniper grows on Rough broken land; and cottonwood and willow grow on bottom-land soils.

Antelope, deer, squirrel, bobcat, raccoon, rabbit, coyote, opposum, and badger inhabit this site. The main birds are turkey, dove, quail, prairie chicken, ducks, geese, and songbirds. Largemouth bass, channel catfish, and bream are suitable for stocking farm ponds in this site.

Engineering Uses of the Soils [5]

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation upon which to build structures. In this section are discussed those properties of the soils that affect construction and maintenance of roads, airports, pipelines, building foundations, recreational areas, water storage facilities, erosion control structures, and sewage disposal systems.

Among the soil properties most important in engineering are permeability, compressibility, shear strength, density, shrink-swell potential, available water capacity, grain-size distribution plasticity, and reaction. Information concerning these and related soil properties are given in tables 3, 4, and 5. The estimates and interpretations in these tables can be used in—

1. Planning farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of sand and soil material suitable for use in construction.
4. Selecting potential industrial, commercial, residential, and recreational areas.

The engineering estimates reported here do not eliminate the need for sampling and testing at the site of specific engineering works, especially works that involve

[5] By DAN C. HUCKABEE, area engineer, Soil Conservation Service, Amarillo, Texas.

TABLE 3.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in that series is made up of two or more kinds of soil. For this < means

Soil series and map symbols	Hydrologic group	Depth from surface	USDA texture	Classification	
				Unified	AASHO
		Inches			
Capps: CaA, CaB	B	0–35	Clay loam	CL	A–6, A–7–6
		35–60	Clay loam	CL	A–6
Cass: Cf	A	0–40	Fine sandy loam	SM	A–4
		40–60	Loam	CL	A–6
Conlen: CoA, CoB, CoC, CoD	B	0–10	Loam	ML, SM, CL, SC	A–6, A–4
		10–30	Clay loam	ML, CL, SC	A–6
		30–60	Clay loam	ML, CL	A–6
Dalhart: DaA, DaB, DaC	B	0–9	Fine sandy loam	SM	A–4
		9–35	Sandy clay loam	CL	A–6
		35–45	Fine sandy loam	SM, SC, CL	A–4 or A–6
*Dumas: DmA, DmB, DmC, DtC For Tascosa part of DtC, see Tascosa series.	B	0–16	Loam	CL	A–4
		16–37	Clay loam	CL	A–6
		37–64	Silty clay loam	CL	A–6 or A–7
*Ector: EcE For Ulysses part, see Ulysses series.	D	0–8	Gravelly loam	GC, SC	A–1, A–2
		8–15	Limestone.		

heavy loads or excavations to depths greater than those described. The estimated values for bearing strength and traffic-supporting capacity expressed in words should not be assigned specific values. There are small areas of other soils and contrasting situations included in the mapping units that may have different engineering properties than those listed. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that can be expected.

Some terms used by soil scientists may be unfamiliar to engineers, and some words have different meanings in soil science than in engineering. Among the terms that have special meaning in soil science are gravel, sand, silt, clay, loam, surface, subsoil layer and horizon. These and other terms are defined in the Glossary at the back of this survey.

Engineering classification systems

The two systems most commonly used in classifying samples of soil for engineering uses are the AASHO system (*1*), adopted by the American Association of State Highway Officials, and the Unified system (*7*), used by SCS engineers, the Department of Defense, and others.

The AASHO system classifies soils according to properties that affect their use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups, A–1 to A–7, on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength. At the other extreme, A–7, are clay soils that have low strength when wet. The best soils for subgrade are therefore classified as A–1, the next best A–2, and so on to class A–7, the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. If soil material is near a classification boundary, it is given a symbol showing both classes; for example, A–2 or A–4. Within each group, the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped into 15 classes. There are eight classes of coarse-grained soils. identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, SM–SC.

The estimated AASHO and Unified classifications are given in table 3 for all soils mapped in Moore County.

Estimated physical and chemical properties

Table 3 gives estimates of soil properties important to engineering. The estimates are based on field classification and descriptions, on physical and chemical tests of selected representative samples, on test data from similar soils in adjacent areas, and on detailed experience in working with the individual kinds of soil in the survey area.

significant to engineering

reason the reader should follow carefully the instructions for referring to other series in the first column of this table. The symbol less than]

Percentage passing sieve—				Permeability	Reaction	Available water capacity	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*pH*	*Inches per inch of soil*	
98–100	98–100	95–99	60–70	0. 63–2. 0	6. 6–8. 4	0. 18–0. 20	Moderate.
90–100	80–90	75–85	50–70	0. 63–2. 0	7. 9–8. 4	0. 12–0. 16	Low.
98–100	90–100	65–80	35–50	2. 0–6. 3	7. 9–8. 4	0. 11–0. 13	Low.
100	95–100	80–90	65–75	0. 63–2. 0	7. 9–8. 4	0. 16–0. 18	Low.
95–100	95–98	85–95	35–70	0. 63–2. 0	7. 9–8. 4	0. 16–0. 18	Low.
90–100	85–98	85–95	40–80	0. 63–2. 0	7. 9–8. 4	0. 12–0. 16	Low.
98–100	95–100	80–98	50–80	0. 63–2. 0	7. 9–8. 4	0. 14–0. 18	Low.
100	95–100	70–85	40–50	2. 0–6. 3	6. 6–7. 3	0. 11–0. 13	Low.
100	95–100	80–90	50–65	0. 63–2. 0	6. 6–8. 4	0. 16–0. 18	Low.
100	95–100	75–85	40–65	0. 63–2. 0	7. 9–8. 4	0. 11–0. 13	Low.
100	100	95–100	50–65	0. 63–2. 0	6. 6–7. 3	0. 14–0. 16	Low.
100	95–100	95–100	65–75	0. 63–2. 0	6. 6–7. 3	0. 16–0. 18	Moderate.
100	95–100	85–95	60–75	0. 63–2. 0	7. 9–8. 4	0. 16–0. 18	Moderate.
30–70	20–65	15–50	12–35	0. 63–2. 0	7. 9–8. 4	0. 07–0. 09	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth from surface	USDA texture	Classification	
				Unified	AASHO
		Inches			
Enterprise: EnD	B	0–50	Very fine sandy loam	ML–CL, CL	A–4
Harney: HaA, HaB	C	0–60	Clay loam	CL	A–6
Humbarger: Hu	B	0–15	Loam	CL	A–4 or A–6
		15–60	Clay loam	CL	A–6
Likes: LkC, LlC	A	0–50	Loamy fine sand	SM–SC or SM	A–2
Lincoln: Ln	A	0–38	Loamy fine sand	SM	A–4 or A–2
		38–60	Fine sand	SM	A–2
Manzano: MaB	B	0–60	Clay loam	CL	A–6
*Mobeetie: MrB, MrC, MrD, MvC—For Pastura and Veal parts of MvC, see Pastura and Veal series.	B	0–40	Fine sandy loam	SM or SC	A–4
Ness: Nc	D	0–60	Clay	CH	A–7
Pastura: PaE	C	0–8	Gravelly loam	SC or SM–SC	A–4 or A–6
		8–18	Caliche.		
Rough broken land: Ro. Too variable to be rated.					
Sherm: ShA, ShB	D	0–6	Silty clay loam	CL	A–6, A–7–6
		6–45	Clay	CH	A–7
		45–72	Clay loam	CL	A–6, A–7–6
*Springer: SrD, SsB—For Likes part of SsB, see Likes series.	B	0–12	Loamy fine sand	SM or SP–SM	A–3, A–2–4
		12–60	Fine sandy loam	SM or SM–SC	A–2–4
Sunray: SuA, SuB	B	0–12	Loam	CL	A–6
		12–60	Clay loam	CL	A–6, A–7–6
*Tascosa: TaE, TmC—For Mobeetie and Springer parts of TmC, see Mobeetie and Springer series.	B	0–60	Gravelly loam, very gravelly loam, and very gravelly sandy loam.	GM or GC	A–1
Tivoli: TvC	A	0–60	Fine sand	SP–SM	A–2, A–3
*Ulysses: UsC, UsD—For Sunray part, see Sunray series.	B	0–11	Loam	CL	A–6, A–4
		11–60	Clay loam	CL	A–6
Veal: VeB, VeD	B	0–8	Fine sandy loam	SM, SC	A–4, A–2–4
		8–15	Sandy clay loam	CL, SC	A–6
		15–40	Fine sandy loam	SM, SC	A–4
Vernon: VnD	D	0–7	Clay loam	CL	A–6 or A–7
		7–45	Clay	CH	A–7

significant to engineering—Continued

Percentage passing sieve—				Permeability	Reaction	Available water capacity	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*pH*	*Inches per inch of soil*	
100	100	85–95	60–90	2. 0–6. 3	7. 9–8. 4	0. 18–0. 20	Low.
95–100	85–95	80–95	65–80	0. 20–0. 63	7. 9–8. 4	0. 16–0. 18	Moderate.
100	95–100	85–95	50–65	0. 63–2. 0	7. 9–8. 4	0. 14–0. 16	Low.
100	95–100	90–100	70–80	0. 63–2. 0	7. 9–8. 4	0. 16–0. 18	Low.
95–98	95–98	75–95	12–30	2. 0–6. 3	7. 9–8. 4	0. 07–0. 09	Low.
100	100	65–80	20–40	6. 3–20. 0	7. 9–8. 4	0. 07–0. 09	Low.
100	90–100	50–70	15–25	6. 3–20. 0	7. 9–8. 4	0. 05–0. 07	Low.
100	95–100	85–95	60–75	0. 63–2. 0	6. 6–8. 4	0. 16–0. 18	Low.
100	90–100	65–80	35–50	2. 0–6. 3	7. 9–8. 4	0. 11–0. 13	Low.
100	95–100	90–100	80–95	<0. 06	6. 6–7. 3	0. 19–0. 21	High.
80–100	70–80	60–70	40–50	0. 63–2. 0	7. 9–8. 4	0. 08–0. 10	Low.
100	100	100	85–95	0. 06–0. 20	6. 6–7. 3	0. 16–0. 18	Moderate.
100	100	100	80–95	<0. 06	6. 6–8. 4	0. 18–0. 19	High.
97–100	95–100	94–99	80–92	0. 20–0. 63	7. 9–8. 4	0. 13–0. 17	Moderate.
100	95–100	70–85	8–35	6. 3–20. 0	6. 6–7. 3	0. 07–0. 09	Low.
100	95–100	80–95	11–35	2. 0–6. 3	6. 6–7. 3	0. 11–0. 13	Low.
98–100	95–100	95–100	70–80	0. 63–2. 0	7. 9–8. 4	0. 16–0. 18	Low.
95–100	95–100	85–90	60–75	0. 63–2. 0	7. 9–8. 4	0. 16–0. 18	Low.
50–60	25–50	20–30	15–25	0. 63–2. 0	7. 9–8. 4	0. 07–0. 09	Low.
100	95–100	50–70	5–12	6. 3–20. 0	6. 6–7. 3	0. 05–0. 07	Low.
98–100	95–100	70–85	50–65	0. 63–2. 0	7. 9–8. 4	0. 16–0. 17	Low.
98–100	95–100	90–95	70–80	0. 63–2. 0	7. 9–8. 4	0. 16–0. 18	Low.
95–100	95–100	85–95	30–50	2. 0–6. 3	7. 9–8. 4	0. 11–0. 13	Low.
95–100	95–100	90–100	40–65	0. 63–2. 0	7. 9–8. 4	0. 12–0. 16	Low.
95–100	95–100	85–95	35–50	2. 0–6. 3	7. 9–8. 4	0. 11–0. 13	Low.
95–100	90–100	90–100	80–90	0. 20–0. 63	7. 9–8. 4	0. 16–0. 17	Moderate.
90–100	85–100	70–100	70–90	<0. 06	7. 9–8. 4	0. 10–0. 12	High.

TABLE 4.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in that series is made up of two or more kinds of soil.

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—		
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields
Capps: CaA, CaB	Fair: clay loam texture.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Slight
Cass: Cf	Good	Fair: fair traffic-supporting capacity.	Fair: fair traffic-supporting capacity; hazard of flooding.	Severe: hazard of flooding.	Moderate: hazard of flooding.
Conlen: CoA, CoB, CoC, CoD	Fair: 7 to 10 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight where slopes are 0 to 5 percent. Moderate where slopes are 5 to 8 percent.
Dalhart: DaA, DaB, DaC	Fair: 9 to 12 inches of fine sandy loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight
*Dumas: DmA, DmB, DmC, DtC For Tascosa part of DtC, see Tascosa series.	Fair: 10 to 12 inches of loam.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Moderate: moderate permeability.
*Ector: EcE For Ulysses part, see Ulysses series.	Poor: 45 to 60 percent coarse fragments.	Poor: 4 to 12 inches of material.	Severe: 4 to 12 inches to bedrock.	Severe: 4 to 12 inches to bedrock.	Severe: 4 to 12 inches to bedrock.
Enterprise: EnD	Good	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight
Harney: HaA, HaB	Fair: clay loam texture.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability.
Humbarger: Hu	Good where loam is 20 to 30 inches thick. Fair where loam is 12 to 20 inches thick.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; hazard of flooding.	Severe: hazard of flooding.	Moderate: moderate permeability; hazard of flooding.

interpretations of the soils

For this reason the reader should follow carefully the instructions for referring to other series in the first column of this table]

Degree of limitations and soil features affecting—Continued			Soil features affecting—			Corrosivity of uncoated steel
Sewage lagoons	Farm ponds		Irrigation	Terraces and diversions	Grassed waterways	
	Reservoir areas	Embankments				
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Features favorable.	Features favorable.	Features favorable.	Moderate: clay loam texture.
Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderately rapid permeability.	Erodibility; hazard of flooding.	Erodibility; hazard of flooding.	High: conductivity.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Moderate permeability.	Shallow to caliche.	Erodibility-----	Moderate: clay loam texture.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: poor resistance to piping and erosion.	Moderate permeability.	Erodibility-----	Erodibility-----	High: conductivity.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Features favorable.	Features favorable.	Erodibility-----	Moderate: resistivity.
Severe: 4 to 12 inches to bedrock.	Severe: 4 to 12 inches to bedrock.	Severe: 4 to 12 inches of material.	4 to 12 inches to bedrock.	4 to 12 inches to bedrock.	4 to 12 inches to bedrock.	High: conductivity.
Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderately rapid permeability; slope.	Slope----------	Slope----------	High: conductivity.
Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.	Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Features favorable.	Features favorable.	Features favorable.	High: conductivity.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Features favorable.	Features favorable.	Erodibility; siltation.	High: conductivity.

TABLE 4.—*Engineering interpretations*

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—		
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields
Likes: LkC, LlC	Poor: loamy fine sand texture.	Good	Slight	Slight	Slight
Lincoln: Ln	Poor: loamy fine sand texture.	Good	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.
Manzano: MaB	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Moderate: moderate permeability.
*Mobeetie: MrB, MrC, MrD, MvC. For Pastura and Veal parts of MvC, see Pastura and Veal series.	Good	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight where slopes are 1 to 6 percent. Moderate where slopes are 6 to 12 percent.	Slight where slopes are 1 to 6 percent. Moderate where slopes are 6 to 12 percent.
Ness: Nc	Poor: clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.
Pastura: PaE	Poor: 20 percent coarse fragments; 4 to 6 inches of material.	Good	Slight where slopes are 1 to 6 percent. Moderate where slopes are 6 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight where slopes are 1 to 6 percent. Moderate where slopes are 6 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 1 to 10 percent: moderately permeable. Severe where slopes are 10 to 20 percent.
Rough broken land: Ro. Too variable to classify.					
Sherm: ShA, ShB	Poor where silty clay loam is 4 to 6 inches thick. Fair where silty clay loam is 6 to 7 inches thick.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.
*Springer: SrD, SsB. For Likes part of SsB, see Likes series.	Poor where texture is loamy fine sand. Fair where fine sandy loam is 10 to 20 inches thick.	Good	Slight where slopes are 1 to 6 percent. Moderate where slopes are 6 to 8 percent.	Slight where slopes are 1 to 6 percent. Moderate where slopes are 6 to 8 percent.	Slight where slopes are 1 to 5 percent. Moderate where slopes are 5 to 8 percent.

of the soils—Continued

Degree of limitations and soil features affecting—Continued			Soil features affecting—			Corrosivity of uncoated steel
Sewage lagoons	Farm ponds		Irrigation	Terraces and diversions	Grassed waterways	
	Reservoir areas	Embankments				
Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderately rapid permeability.	Erodibility	Erodibility	High: conductivity.
Severe: rapid permeability.	Severe: rapid permeability.	Moderate: poor resistance to piping and erosion.	Rapid permeability.	Erodibility	Erodibility	High: conductivity.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Receives outside runoff water.	Features favorable.	Features favorable.	High: conductivity.
Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderately rapid permeability.	Erodibility	Erodibility	High: conductivity.
Slight	Slight	Moderate: fair slope stability.	Very slow permeability; hazard of flooding.	Clay texture; hazard of flooding.	Clay texture; hazard of flooding.	High: clay texture; poorly drained.
Severe: seepage; slopes of 7 to 20 percent.	Severe: 4 to 12 inches to weakly cemented caliche.	Severe: 4 to 12 inches to weakly cemented caliche.	4 to 12 inches to weakly cemented caliche.	4 to 12 inches to weakly cemented caliche.	4 to 12 inches to weakly cemented caliche.	High: conductivity.
Slight	Slight	Moderate: fair resistance to piping and erosion.	Features favorable.	Features favorable.	Features favorable.	High: conductivity.
Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderately rapid permeability.	Erodibility	Erodibility	Low.

TABLE 4.—*Engineering interpretations*

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—		
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields
Sunray: SuA, SuB	Fair: 8 to 12 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight
*Tascosa: TaE, TmC For Mobeetie and Springer parts of TmC, see Mobeetie and Springer series.	Poor: 35 percent coarse fragments.	Good	Slight where slopes are 3 to 6 percent. Moderate where slopes are 6 to 15 percent. Severe where slopes are 15 to 45 percent.	Slight where slopes are 3 to 6 percent. Moderate where slopes are 6 to 15 percent. Severe where slopes are 15 to 45 percent.	Moderate where slopes are 3 to 10 percent: moderate permeability. Severe where slopes are 10 to 45 percent.
Tivoli: TvC	Poor: fine sand texture.	Good	Slight	Slight	Severe: inadequate filtration.
*Ulysses: UsC, UsD For Sunray part, see Sunray series.	Fair: 9 to 12 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; slopes of 6 to 8 percent.	Slight where slopes are 3 to 6 percent. Moderate where slopes are 6 to 8 percent.	Moderate: moderate permeability; slopes of 5 to 8 percent.
Veal: VeB, VeD	Poor: calcium carbonate equivalent of 30 to 35 percent.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight
Vernon: VnD	Fair: clay loam texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.

of the soils—Continued

Degree of limitations and soil features affecting -Continued			Soil features affecting—			Corrosivity of uncoated steel
Sewage lagoons	Farm ponds		Irrigation	Terraces and diversions	Grassed waterways	
	Reservoir areas	Embankments				
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Features favorable.	Features favorable.	Features favorable.	Moderate: clay loam texture.
Severe: 50 to 80 percent coarse fragments.	Severe: 50 to 80 percent coarse fragments.	Moderate: poor resistance to piping and erosion.	Gravelly soil	Gravelly soil	Gravelly soil	High: conductivity.
Severe: rapid permeability.	Severe: rapid permeability.	Severe: poor resistance to piping and erosion.	Erodibility	Erodibility	Erodibility	Low.
Moderate where slopes are 3 to 7 percent: moderate permeability. Severe where slopes are 7 to 8 percent.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Slope	Features favorable.	Features favorable.	High: conductivity.
Severe: seepage	Severe: seepage.	Moderate: fair resistance to piping and erosion.	Slope; moderate permeability.	Erodibility	Erodibility	Moderate: conductivity.
Moderate where slopes are 3 to 7 percent. Severe where slopes are 7 to 8 percent.	Slight	Moderate: fair slope stability.	Very slow permeability.	Features favorable.	Features favorable.	High: clay texture; conductivity.

TABLE 5.—*Interpretations for recreational uses of the soils*

[An asterisk in the first column indicates that at least one mapping unit in that series is made up of two or more kinds of soil. For this reason the reader should follow carefully the instructions for referring to other series in the first column of this table]

Soil series and map symbols	Degree of limitations and soil features affecting—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Capps: CaA, CaB	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.
Cass: Cf	Severe: hazard of flooding.	Moderate: hazard of flooding.	Moderate: hazard of flooding.	Slight.
Conlen: CoA, CoB, CoC, CoD	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent. Severe where slopes are 6 to 8 percent.	Slight.
Dalhart: DaA, DaB, DaC	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 5 percent.	Slight.
*Dumas: DmA, DmB, DmC, DtC. For Tascosa part of DtC, see Tascosa series.	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 5 percent.	Slight.
*Ector: EcE For Ulysses part, see Ulysses series.	Moderate where slopes are 8 to 15 percent: 45 to 50 percent coarse fragments. Severe where slopes are 15 to 30 percent: 50 to 60 percent coarse fragments.	Moderate where slopes are 8 to 15 percent: 45 to 50 percent coarse fragments. Severe where slopes are 15 to 30 percent: 50 to 60 percent coarse fragments.	Severe: 4 to 12 inches to bedrock; 20 to 60 percent coarse fragments; slopes of 6 to 30 percent.	Moderate where slopes are 15 to 25 percent: 45 to 50 percent coarse fragments. Severe where slopes are 25 to 30 percent: 50 to 60 percent coarse fragments.
Enterprise: EnD	Slight	Slight	Moderate where slopes are 5 to 6 percent. Severe where slopes are 6 to 8 percent.	Slight.
Harney: HaA, HaB	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture; slopes of 2 to 3 percent.	Moderate: clay loam texture.
Humbarger: Hu	Slight	Slight	Slight	Slight.
Likes: LkC, LlC	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.
Lincoln: Ln	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Moderate: hazard of flooding; loamy fine sand texture.
Manzano: MaB	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture; slopes of 2 to 3 percent.	Moderate: clay loam texture.
*Mobeetie: MrB, MrC, MrD, MvC. For Pastura and Veal parts of MvC, see Pastura and Veal series.	Slight where slopes are 1 to 8 percent. Moderate where slopes are 8 to 12 percent.	Slight where slopes are 1 to 8 percent. Moderate where slopes are 8 to 12 percent.	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 6 percent. Severe where slopes are 6 to 12 percent.	Slight.

TABLE 5.—*Interpretations for recreational uses of the soils*—Continued

Soil series and map symbols	Degree of limitations and soil features affecting—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ness: Nc	Severe: clay texture; poorly drained; very slow permeability.	Severe: clay texture; poorly drained.	Severe: clay texture; poorly drained; very slow permeability.	Severe: clay texture; poorly drained.
Pastura: PaE	Slight where slopes are 1 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight where slopes are 1 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 6 percent. Severe where slopes are 6 to 20 percent.	Slight where slopes are 1 to 15 percent. Moderate where slopes are 15 to 20 percent.
Rough broken land: Ro. Too variable to classify.				
Sherm: ShA, ShB	Moderate: silty clay loam texture; very slow permeability.	Moderate: silty clay loam texture; very slow permeability.	Moderate: silty clay loam texture; very slow permeability.	Moderate: silty clay loam texture.
*Springer: SrD, SsB. For Likes part of SsB, see Likes series.	Slight where texture is fine sandy loam. Moderate where texture is loamy fine sand.	Slight where texture is fine sandy loam. Moderate where texture loamy fine sand.	Moderate where slopes are 2 to 6 percent: loamy fine sand texture. Severe where slopes are 6 to 8 percent.	Slight where texture is fine sandy loam. Moderate where texture is loamy fine sand.
Sunray: SuA, SuB	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.	Slight.
*Tascosa: TaE, TmC. For Mobeetie and Springer parts of TmC, see Mobeetie and Springer series.	Severe: 50 percent coarse fragments; slopes of 15 to 45 percent.	Severe: 50 percent coarse fragments; slopes of 15 to 45 percent.	Severe: 50 percent coarse fragments; slopes of 6 to 45 percent.	Severe: 50 percent coarse fragments; slopes of 25 to 45 percent.
Tivoli: TvC	Severe: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.
*Ulysses: UsC, UsD. For Sunray part, see Sunray series.	Slight	Slight	Moderate where slopes are 3 to 6 percent. Severe where slopes are 6 to 8 percent.	Slight.
Veal: VeB, VeD	Slight	Slight	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 6 percent. Severe where slopes are 6 to 8 percent.	Slight.
Vernon: VnD	Severe: very slow permeability.	Moderate: clay loam texture.	Severe: very slow permeability.	Moderate: clay loam texture.

Depth to bedrock for most soils in Moore County is well beyond the depths to which the soils were investigated in field mapping. Many logs from well drillers indicate that bedrock occurs only in the red beds, which are from 300 feet to 500 feet below the surface. The depth to limestone bedrock is 4 to 12 inches for Ector soils.

A seasonal high water table is not a limitation in Moore County. Seasonal flooding occurs on Ness soils, which are in and around playas, and on bottom-land soils, such as Manzano soils. This flooding often results in saturation of the soils, but this saturation does not constitute a seasonal high water table.

Hydrologic soil groups indicate the potential runoff of rainfall. Four groups are used. The soils are classified on the basis of intake of water at the end of long storms after prior wetting and opportunity for swelling, and without the protection of vegetation.

The hydrologic soil groups are—

A. (Low runoff potential) Soils that have a high infiltration rate even when thoroughly wetted. These are chiefly deep, well-drained to excessively drained, coarse-textured soils. These soils have a high rate of water transmission.

B. Soils that have a moderate infiltration rate when thoroughly wetted. These are chiefly moderately fine textured to moderately coarse textured soils. These soils have a moderate rate of water transmission.

C. Soils that have a slow infiltration rate when thoroughly wetted. These are chiefly soils that have a layer that impedes downward movement of water and soils that have moderately fine texture to fine texture. These soils have a slow rate of water transmission.

D. (High runoff potential) Soils that have a very slow infiltration rate when thoroughly wetted. These are chiefly clay soils that have high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Sand," "silt," "clay," and some of the other standard terms used in the USDA textural classification are defined in the Glossary.

Permeability is that quality of a soil that enables it to transmit water. As used in table 3, permeability relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Reaction is the degree of acidity or alkalinity of a soil, expressed as pH. The pH value, and the terms used to describe soil reaction, are explained in the Glossary.

Available water capacity is the amount of water a soil can hold and make available to plants. It is the difference between the amount of water at field capacity and the amount of water at the wilting point of most crop plants. Available water capacity is expressed as inches of water per inch of soil depth.

Shrink-swell potential indicates the volume change to be expected of the soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or of such materials.

Engineering interpretations

Table 4 contains information useful to engineers and to others who plan to use the soils in the construction of highways, farm facilities, buildings, sewage disposal systems, and ponds and reservoirs. The suitability and limitations of the soils both as building material and as a base for construction are given. The ratings and other interpretations in this table are based on the estimated engineering properties of the soils in table 3; on available test data; and on field experience. Although the information applies only to soil depths indicated in table 3, it is reasonably reliable to a depth of about 6 feet for most soils, and several feet for some soils.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties are generally favorable for the rated use, or limitations are minor and easy to overcome. *Moderate* means some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to overcome that major soil reclamation and special designs are required.

Soil suitability is rated by the terms good, fair, and poor, which have meanings parallel to the terms slight, moderate, and severe.

Only Tascosa soils can be used as a source of sand or gravel in Moore County. Soils of the Pastura series offer a source of caliche at fairly shallow depths. This caliche can be mined from open pits.

Topsoil is fertile soil material, commonly rich in organic matter, that is used as a topdressing for lawns, gardens, roadbanks, and the like.

Road subgrade is material used to build road embankments. Ratings indicate performance of soil material moved from borrow areas.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features listed, favorable as well as unfavorable, are the principal ones that affect highway location.

Foundations for low buildings are affected chiefly by features of the undisturbed soil that influence its capacity to support low buildings that have normal foundation loads. Specific values of bearing strength are not assigned.

Septic tank filter fields are affected mainly by permeability, location of the water table, and susceptibility to flooding.

Sewage lagoons are influenced chiefly by permeability, location of the water table, and slope.

Farm pond reservoir areas are affected mainly by loss of water through seepage, and the soil features listed are those that influenced seepage.

Farm pond embankments serve as dams. The soil features listed, of both subsoil and substratum, are those important to the use of soils for constructing embankments.

Irrigation is affected by slope, permeability, depth of the soil, and hazard of flooding that could wash out irrigation borders and tabs.

Terraces and diversions are affected by potential cracking, depth of the soil, and slope. These structures are not ordinarily used on some soils.

Grassed waterways are natural or shaped watercourses that have a close-growing grass cover and are used to carry excess water off the terraces. Soil features that affect waterways include potential cracking, water-holding capacity, soil structure, depth of the soil, slope, and erodibility.

Corrosivity of uncoated steel is affected by drainage, texture, acidity, resitivity, and conductivity. Soils are rated at a depth of 4 feet. The soils of Moore County are all rated low for corrosivity of concrete, and a column for that property has not been shown in the table.

Recreational interpretations

Table 5 contains information useful to those who plan to use the soils for recreational facilities. The ratings are based on the estimated engineering properties of the soils in table 3; on available test data; and on field experience.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties are generally favorable for the rated use, or limitations are minor and easy to overcome. *Moderate* means some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to overcome that major soil reclamation and special designs are required.

Camp areas for overnight or week-long camping should be on soils that do not require surfacing for parking and that have no hardpan. Load bearing strength, flooding, dustiness or muddiness, slope, and stoniness are used in rating.

Picnic areas are tree-shaded parklands that have tables and cooking grills and are readily accessible. Flooding, slope, texture of the surface layer, and the amount of coarse fragments on the surface are considered. Presence of an access road is assumed.

Playgrounds are used intensively for such sports as baseball, football, volleyball, and soccer. These areas are subject to intensive foot traffic. They should be nearly level, have good drainage, and have a firm surface that is free of rock outcrops and stones.

Paths and trails are footpaths, hiking trails, and bridle paths. It is assumed that only enough vegetation is removed to provide a pathway and that little or no excavation of fill is made along the pathway. Important soil features are muddiness or dustiness, a stony or gravelly surface, slope, flooding, and ease of design and maintenance to minimize erosion.

Formation, Morphology, and Classification of the Soils

This section has three parts. In the first part the factors of soil formation are discussed as they relate to the formation of the soils in Moore County. The second part briefly discusses the morphology of the soils in the county. In the third part the soils represented in the county are placed in some of the categories of the system of classification.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil at any given place are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time these forces have acted on the material. All five factors influence the present characteristics of every soil, but the significance of each factor varies from one place to another. In one area one factor may dominate soil formation; in another area a different factor may be important

The interrelationship of these factors is complex, and the effects of any one factor cannot be isolated and completely evaluated. It is convenient, however, to discuss each factor separately and to indicate the probable effects of each.

Parent material

Parent material has probably had more influence on the characteristics of the soils in Moore County than any other factor. The soils developed in two geologic formations, the High Plains deposits and the underlying Permian red beds.

The High Plains deposits are divided into two parts. The upper part is an eolian mantle a few feet to about 100 feet thick. The lower part is the Ogallala Formation.

The eolian mantle blankets most of the part of the County in the High Plains (*3*). It consists of alternating layers of clay loam, clay, sandy clay loam, and loam and interbedded layers of soft, pinkish-white caliche. The soil that formed at any given place appears to depend largely on the kind of parent material exposed at that place when soil formation began. For example, Sherm and Harney soils formed in material from the finer textured layers. Conlen, Sunray, and Ulysses soils are calcareous because they formed in limy layers. Dalhart and Dumas soils formed in the less calcareous loamy sediment.

Some soils formed in reworked sediment of the eolian mantle, that is, sediment that has been washed or blown since the original deposition. Ness soils formed in material washed from the surrounding slopes into playa basins. Manzano soils formed in valley fill. Humbarger soils formed on flood plains.

The Ogallala Formation is 200 feet to about 700 feet thick. It consists of limy outwash loams, sands, and

gravels. Pastura soils developed in the thick beds of caliche in the upper part of the formation. Tascosa soils developed in the beds of quartz gravel in the base of the Ogallala Formation. Likes and Tivoli soils formed in beds of wind-worked, sandy sediment. Lincoln soils formed in sandy sediment deposited along flood plains. Mobeetie soils developed in calcareous sandy loam sediment on foot slopes.

The Permian and Triassic red beds underlie the Ogallala Formation. They make up the broken escarpment and the rough areas along creeks and canyons. Ector soils formed in limestone strata that lie at the top of the Permian beds. Vernon soils developed in clayey red beds on slopes below the escarpment. Enterprise soils are in loamy red beds on foot slopes.

Climate

Moore County has a dry, steppe climate. The average annual precipitation is 18.95 inches, but precipitation fluctuates greatly from year to year. Most rainfall comes in summer as short, hard showers. The winter is mostly dry and windy and has few snows.

Climate has affected the soils of Moore County in several ways. For example, there has not been enough rainfall to leach carbonates out of the soil. Thus the carbonates have accumulated in the lower part of the soils at about the average depth to which rainfall penetrates. Therefore, most soils are underlain by a layer of soft, pinkish caliche earths.

In Dalhart, Dumas, Harney, and Sherm soils, the free carbonates have been leached out of the upper part of the solum. In Conlen, Sunray, and Ulysses soils, and in other soils forming in sediment that is high in lime, the process is still going on and some free lime remains in the upper part of the solum.

In some soils, such as Sherm soils, clay is moving from the surface layer into the subsoil. This is indicated by the presence of clay films, or coatings, on the surfaces of peds in the subsoil. The downward movement of clay is similar to the downward movement of carbonates, but it takes place at a much slower rate and apparently only after the carbonates have been leached out.

Local differences in climate are apparent in the escarpment area. Soils that have north-facing slopes are protected from the sun and the warm southwesterly winds. These soils are cooler and more moist than those that have the unprotected south-facing slopes. Therefore, the grass cover is denser and taller.

Plant and animal life

Plants, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to its development. The kinds of organisms are determined mainly by climate and parent material.

The natural vegetation in Moore County consisted mainly of grasses. The kind of parent material in which the soil formed determined whether the grasses would be tall or short species. The grasses helped to stabilize the landscape and added organic matter to the soil. As the roots decayed, they fed bacteria and fungi. The network of pores and tubes left by decaying roots helped the passage of air and water through the soils.

Micro-organisms are important in soil formation. They help to break down plant residue, to release plant nutrients from the parent material, and to fix nitrogen from the air in the soil.

In most of the soils, earthworms are the most obvious animals. Worm casts are round, granular excretions left by burrowing earthworms.

Rodents, such as prairie dogs and gophers, influence the development of soils. When digging, they mix the soil material vertically as well as horizontally. Nests and burrows made by rodents range from about 4 to 18 inches in diameter. They are filled with grayish-brown, silty earths that are high in organic matter. The workings of rodents tend to make soils more permeable.

Bison, deer, rabbits, antelope, and other animals have also affected soil formation by grazing, trampling, bedding, and manuring.

Relief

Relief influences the formation of soils mainly through its effect on drainage and runoff. If the other factors of soil formation are equal, a difference in the degree of development of two soils depends largely on different amounts of moisture entering and passing through the soils. Some soils, such as Sherm, Harney, Dalhart, and Dumas soils, are nearly level to gently sloping. Most of the rainfall enters these soils; and therefore relief has aided their development.

Sloping soils have more runoff and absorb less water than more nearly level soils. Therefore, they are subject to more erosion and are generally thinner. Pastura soils are gently sloping to moderately steep. Because runoff is rapid and geologic erosion is active on these soils, time, vegetation, and climate can sustain only a very shallow to shallow soil.

Ness soils are affected by relief another way. They are periodically flooded and inundated and gain sediment from the surrounding area each year.

Time

Time is required for a soil to form. The time required depends on parent material, climate, plant and animal life, and relief.

Some soils are thought to be stable in their environment. They change little as time passes, because the environmental factors have made their changes on the parent material. Dumas, Harney, and Sherm soils have been in place long enough to develop distinct A, B, and C horizons.

In some soils climate, plant and animal life, and relief have only begun to alter the parent material. Those factors are making their impression on the soil, but more time is needed for distinct horizons to form. Thus, the age of a soil is determined by the degree to which the parent material has been changed toward the full development of a soil profile that has a unique set of characteristics.

Morphology of the Soils

The effects of soil-forming factors on the soil are recorded in the soil profile—a succession of layers, or hori-

zons, from the surface down to bedrock or into the parent material. Horizons differ in one or more properties, such as color, texture, structure, consistence, porosity, or reaction (*5*). They may be thick or thin.

Most profiles contain three major horizons, called A, B or AC, and C. Some young soils have developed no B or AC horizon.

The A horizon is the surface layer. It is the horizon of highest organic-matter content.

The B or the AC horizon lies immediately beneath the A horizon and is called the subsoil or subsurface layer. The B2 horizon, or structural B horizon, is more common in Moore County than the B2t horizon. The B2t horizon is a layer of maximum accumulation of dissolved or suspended materials such as iron or clay. Both B2 and B2t horizons are generally firmer than the horizons immediately above and below and may have subangular blocky or blocky structure. Some soils in Moore County have an AC horizon instead of a B horizon. The AC horizon is transitional between the A and C horizons.

The C horizon has been affected little by the soil-forming processes, but it may have been weathered. The C horizon is generally called the substratum or underlying material.

Several processes were involved in the formation of soil horizons in Moore County. These processes are (1) accumulation of organic matter, (2) leaching of calcium carbonate and bases, (3) reduction and transfer of iron, and (4) formation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in the development of horizons.

Classification of the Soils

Soils are classified so that we may more easily remember their significant characteristics (*4*). Classification enables us to assemble knowledge about soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through the use of soil maps, we can apply our knowledge of soils to specific tracts of land.

Soils are placed in the narrow classes used in detailed soil surveys so that knowledge about the soils can be organized and applied to such uses as managing farms, fields, and woodlands; developing suburbs; and planning engineering works. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of classification defines classes in terms of observable or measurable properties of the soils. The properties chosen are primarily those that group soils that are similar in genesis. Soil genesis, or origin, does not appear in the definitions of the classes; it lies behind the classes. The classification is designed to include all soils. It employs a unique nomenclature that is both connotative and distinctive.

The classification system has six categories. Beginning with the most inclusive, the categories are order, suborder, great group, subgroup, family, and series (*6*).

In table 6, each soil series in Moore County is placed in its family, subgroup, and order of the classification system.

TABLE 6.—*Classification of soil series according to the current system*

Series	Family	Subgroup	Order
Capps	Fine-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Cass	Coarse-loamy, mixed, mesic	Fluventic Haplustolls	Mollisols.
Conlen	Fine-loamy, mixed, mesic	Aridic Calciustolls	Mollisols.
Dalhart	Fine-loamy, mixed, mesic	Aridic Haplustalfs	Alfisols.
Dumas	Fine-loamy, mixed, mesic	Aridic Paleustolls	Mollisols.
Ector	Loamy-skeletal, carbonatic, thermic	Lithic Calciustolls	Mollisols.
Enterprise	Coarse-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Harney	Fine, montmorillonitic, mesic	Typic Argiustolls	Mollisols.
Humbarger	Fine-loamy, mixed, mesic	Cumulic Haplustolls	Mollisols.
Likes	Mixed, thermic	Typic Ustipsamments	Entisols.
Lincoln	Sandy, mixed, thermic	Typic Ustifluvents	Entisols.
Manzano	Fine-loamy, mixed, mesic	Cumulic Haplustolls	Mollisols.
Mobeetie [1]	Coarse-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Ness	Fine, montmorillonitic, mesic	Udic Pellusterts	Vertisols.
Pastura	Loamy, mixed, mesic, shallow	Ustollic Paleorthids	Aridisols.
Sherm	Fine, mixed, mesic	Torrertic Paleustolls	Mollisols.
Springer [1]	Coarse-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Sunray	Fine-loamy, mixed, mesic	Calciorthidic Paleustolls	Mollisols.
Tascosa	Loamy-skeletal, mixed, mesic	Aridic Calciustolls	Mollisols.
Tivoli	Mixed, thermic	Typic Ustipsamments	Entisols.
Ulysses	Fine-silty, mixed, mesic	Aridic Haplustolls	Mollisols.
Veal [2]	Fine-loamy, thermic	Aridic Ustochrepts	Inceptisols.
Vernon	Fine, mixed, thermic	Typic Ustochrepts	Inceptisols.

[1] The soils in Moore County classified as this series are near the mesic-thermic line. Most are in the thermic zone, *but* those that have soil temperatures of 56° to 59° F. are taxadjuncts to the series named. This difference does not alter the usefulness or behavior of these soils.

[2] The soils in Moore County classified as this series are near the mesic-thermic line, *but* those that have a soil temperature of less than 59° F. are taxadjuncts to the series. This difference does not alter their usefulness or behavior.

The following paragraphs briefly discuss the categories of the classification system.

ORDER.—Ten soil orders are recognized: Entisols, Vertisols. Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings. The two exceptions are Entisols and Histosols, which occur in many different climates.

Six soil orders are identified in Moore County—Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, and Alfisoils. Entisols are recent and lack genetic horizons or have only the beginnings of such horizons. In Vertisols, natural churning, or inversion, of soil material takes place, mainly through swelling and shrinking of clay. Inceptisols are on young, but not recent, land surfaces. Aridisols have a light-colored surface horizon and are dry most of the time. Mollisols have a thick, dark, friable, soft surface layer that contains more than 1 percent organic matter. Alfisols have a B horizon that has high base saturation.

SUBORDER.—Each order is separated into suborders, primarily on the basis of those characteristics that seem to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range of the orders. The soil properties used to separate suborders are mainly those that reflect the presence or absence of waterlogging or soil differences that result from climate or vegetation.

GREAT GROUP.—Each suborder is separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans that interfere with the growth of roots or the movement of water. The features used include the self-mulching properties of clay, soil temperature, and major differences in chemical composition (mainly of calcium, magnesium, sodium, and potassium).

SUBGROUP.—Each great group is separated into subgroups. One subgroup represents the central (typic) segment of the great group, and others, called intergrades, have properties of that great group and one or more properties of another great group, subgroup, or order. Subgroups may also be made for soil properties that intergrade outside the range of any other great group, subgroup, or order.

FAMILY.—Each subgroup is separated into families, primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES.—The series is a group of soils that have major horizons that, except for the texture of the surface layer, are similar in important characteristics and in arrangement in the profille.

Additional Facts About the County

This section gives information for those not familiar with Moore County. It briefly describes the climate; geology; physiography, relief, and drainage; and history and settlement.

Climate [6]

Moore County has a dry, steppe climate characterized by mild winters. Average annual precipitation is 18.95

[6] By ROBERT B. ORTON, climatologist for Texas, National Weather Service. U.S. Department of Commerce.

TABLE 7.—*Temperature and*

Month	Temperature								
	Average daily maximum	Average daily minimum	Average	Average monthly highest	Average monthly lowest	Average number of days with [1]—			
						Maximum of—		Minimum of—	
						90° and above	32° ad below	32° and below	0° and below
	°F.	°F.	°F.	°F.	°F.				
January	46. 8	19. 1	33. 0	69	0	0	6	29	2
February	52. 1	24. 2	38. 2	74	8	0	4	24	0
March	58. 7	28. 3	43. 5	82	12	0	1	23	[3]
April	70. 7	39. 7	55. 2	89	24	1	0	6	0
May	79. 8	50. 7	65. 3	95	37	8	0	[3]	0
June	88. 3	60. 1	74. 2	100	49	14	0	0	0
July	92. 3	64. 5	78. 4	101	56	22	0	0	0
August	91. 2	63. 2	77. 2	101	54	20	0	0	0
September	84. 0	55. 4	69. 7	97	41	8	0	0	0
October	73. 7	43. 3	58. 5	89	31	1	0	2	0
November	60. 0	29. 9	45. 0	78	15	0	1	19	0
December	54. 0	22. 9	38. 5	71	6	0	4	28	[3]
Year	71. 0	41. 8	56. 4	101	0	74	16	131	2

[1] Based on 10-year average, 1957–1966.
[2] Based on 11-year average, 1956–1966.

inches; snow and sleet make up about 3 inches of this. In 1960 total precipitation at Dumas was 27.24 inches; but in 1966 the total was only 8.18 inches. These amounts are extremes, but there are years of drought when dry-farmed crops produce little or no harvest, followed by years when precipitation is enough to produce profitable crops. Precipitation data for Moore County are given in table 7.

Rain most frequently falls as thundershowers rather than as general rains. This tendency accounts for the extreme variability in amounts. Maximum rainfall is in May, June, July, and August; sixty percent of the average total annual precipitation falls in this 4-month period. Periods of no rain for several weeks or more are not unusual.

Hail may accompany almost any thunderstorm; however, damaging hailstorms are relatively rare and cover small areas. Severe local storms are most frequent in April, May, and June.

From November through March, Moore County is cut off from the Gulf of Mexico moisture source by frequent cold fronts. Average total precipitation in this period is 3.37 inches.

During the cold season, precipitation falls as rain or snow or sometimes as mixed rain and snow. Snowfalls are generally light, and the snow remains on the ground only a short time. Snow is not usually a dependable source of moisture, because strong winds cause heavy drifting and a very uneven cover. On rare occasions in winter, Gulf moisture is carried northward into deep low-pressure centers over the Panhandle or the southern part of the High Plains. These pressure centers bring heavy snow. During the snowstorm of February 3 to 5, 1964, parts of the Texas Panhandle were buried under 18 to 26 inches of snow. Dumas received 18 inches. Winds of 30 to 35 miles per hour piled snow in 8- to 10-foot drifts.

Temperature, like rainfall, is extremely variable, especially from November through April. Cold fronts from the northern Rocky Mountains and Great Plains sweep across the level plains of the Panhandle at 25 to 40 miles per hour. Temperature drops of 50° to 60° F. in a 12-hour period are commonly associated with these fronts, and temperature drops of 30° to 40° in a few minutes have occurred. Normally, the coldest period is mid-January. Cold spells are generally short. Few last more than 2 or 3 days before southwesterly winds from the high New Mexico Plateaus cause rapid warming.

The dry air, high elevation, and usually clear skies of Moore County are ideal for solar radiation; consequently, there is a range, averaging about 28°, between minimum temperature early in the morning and maximum temperature in the afternoon. Temperature data for Moore County are given in table 7. Moore County receives about 74 percent of the total possible annual sunshine.

Summer in Moore County is characterized by warm days and cool nights. The heat of summer is moderated by wind and low humidity during the day. The high elevation and dry air allow rapid radiation after sunset, and summer evenings and nights are pleasantly cool. Evaporative-type home air conditioners are effective in this climate.

Prevailing winds are southerly to southwesterly in all months. Winds are strongest during intense thunderstorms but are of short duration. The strongest continuous winds are in spring in association with migrating low-pressure centers. The strong winds accompanying the most extreme low-pressure centers may cause dust-storms.

Average annual relative humidity is about 72 percent at 6:00 a.m. and 39 percent at 6:00 p.m. Average lake evaporation is estimated to be 64 inches annually.

precipitation at Dumas, Texas

Precipitation									
Average total	Greatest daily	One year in 10 will have—		Average number of days with[2] —			Snow and sleet		
		Less than	More than—	0.10 inch or more	0.50 inch or more	1.00 inch or more	Average total	Greatest monthly	Greatest depth
Inches	*Inches*	*Inches*	*Inches*				*Inches*	*Inches*	*Inches*
0.60	1.59	(4)	1.42	2	0	0	3.9	10.5	6
.61	1.40	0.08	1.11	1	(3)	0	3.8	18.0	18
.93	1.50	(4)	1.87	1	1	(3)	3.4	14.5	7
1.22	1.93	.08	2.50	1	(3)	(3)	.5	4.0	1
2.56	2.50	.41	4.33	4	2	1	0	0	0
2.88	3.76	1.19	5.18	5	2	1	0	0	0
3.56	3.11	.79	7.08	7	2	2	0	0	0
2.45	3.06	.98	4.14	4	1	(3)	0	0	0
1.57	2.61	.03	2.82	3	1	(3)	0	0	0
1.34	3.00	.07	2.77	3	1	(3)	(4)	(4)	0
.48	1.03	0	1.30	2	(3)	(3)	.8	4.5	4
.75	1.27	(4)	1.31	2	0	0	3.8	18.0	9
18.95	3.76	9.67	24.37	35	10	4	16.2	18.0	18

[3] Less than one-half day.
[4] Trace.

The growing season, or freeze-free period, averages 185 days. The average date of the last freeze in spring is April 20. The average date of the first freeze in fall is October 22.

Geology

About 65 percent of Moore County is the nearly level tableland called the High Plains. The rest is the Canadian Breaks.

The origin of the High Plains is important in the geologic history of Moore County. During the Permian Period a large area, including nearly all the present Panhandle of Texas, the eastern part of New Mexico, and the western part of Oklahoma, was under a shallow sea. Sediment deposited in this sea formed what is known as the Permian red beds. After the Permian sea withdrew, the sediment was reworked, other sediment was deposited and Triassic red beds formed in this sediment.

The emergence of the Rocky Mountains during the Pliocene epoch was the next important geologic event. Swift streams flowing from the mountains carried great loads of sediment to form a vast apron to the east and south (*2*). This is the Ogallala Formation. The first deposits of sediment were largely gravel and sand, which gradually built up on the Permian and Triassic red beds to a thickness of 200 to 700 feet in this area. They are the waterbearing strata of the Ogallala Formation.

The next important geologic event was the deposition of the eolian mantle on the surface of the Ogallala Formation during the Pleistocene epoch. This mantle was formed during interglacial periods when the climate was dry, windy, and dessicating. During these periods the Pecos and other rivers were forming to the west and south. Because of the dry climate and prevailing southwesterly winds, fine-textured sediments were blown from the river bottoms and carried northeast. These sediments settled on the Ogallala outwash plain to form a loess mantle 30 to 100 feet thick.

Physiography, Relief, and Drainage

The elevation of Moore County ranges from 3,700 feet in the northwest to 2,900 feet in the southwest.

The High Plains tableland is nearly level but declines to the east at an average slope of about 10 feet per mile. Except for a few low rises and scattered playas, the surface is smooth. The playas are dish shaped and range from less than 1 acre to more than 100 acres in size. Runoff water flows into the playas from the nearly level areas.

The High Plains in Moore County are dissected by two streams, which have cut through the upper part of the High Plains deposits. These are North Palo Duro Creek and South Palo Duro Creek. South Palo Duro Creek begins in the western part of the county, runs eastward, and empties into the Red River drainage system outside Moore County. North Palo Duro Creek runs eastward along the north county line, mainly in Sherman County. It swings south into Moore County in several places.

The Canadian Breaks is in the southeastern part of the county. Here, headwater erosion by tributaries of the Canadian River has cut into the High Plains deposits, and, in the southeastern corner, into the Permain red beds. The Canadian River, which flows across the southeastern corner of the county, has also cut into the red beds. This cutting has built a rugged, scenic country of reddish bluffs, escarpments, steep canyon walls, buttes, mesas, and broken areas along the river and the lower ends of its tributaries.

The higher, outer part of the Canadian Breaks is dominantly rolling country that has a branching drainage system and smooth, convex hills and ridges. The principal drainageways in this area are Blue Creek, Plum Creek, Grapevine Creek, and Running Water Creek. In some places a caliche escarpment that has relief of 5 feet to about 100 feet separates the level High Plains from the rolling Canadian Breaks.

All of the Canadian River bottom lands in Moore County are now in the conservation pool of Lake Meredith. The Lake Meredith dam is in Hutchinson County.

History and Settlement

The area that is now Moore County was originally inhabited by Comanches, Kiowas, Apaches, and other plains Indians who hunted bison, deer, and antelope. White settlers began to come into the area in the 1800's. The first settlers were ranchmen.

Moore County was created from the Bexar Territory in 1876. The County was organized in 1891 and named after Commodore Edwin Ward Moore of the Navy of the Republic of Texas. The city of Dumas, the first town in the County, was officially dedicated on May 29, 1891.

There was no farming until the early 1900's. Extensive farming began only after the tractor came into use in the late 1920's. Farming increased rapidly during the next few years, and the county became an area of extensive dryland farming and ranching. Wheat and grain sorghum were grown in large acreages. Then, in the early 1930's, drought struck the Great Plains. Duststorms, lack of rainfall, and low market prices forced many farmers to leave the area.

The early 1940's brought a series of wet years. Irrigation from deep wells started about this time. Also, much had been learned during the drought about how to farm the soils to control erosion.

The early 1960's saw important advances in the development of irrigation in the county. At present wheat and grain sorghum are the main crops, but silage, corn, sugar beets, and soybeans are becoming important secondary crops.

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Glossary

Acid soil. Generally, a soil that is acid throughout most or all of the part occupied by plant roots. Precisely, any soil having a pH less than 7.0; practically, a soil having a pH less than 6.6.

Aggregate, soil. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alkaline soil. Generally, a soil that is alkaline throughout most or all of the part occupied by plant roots. Precisely, any soil having a pH greater than 7.0; practically, a soil having a pH greater than 7.3.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bottom land. Lowland formed by alluvial deposits along a stream or in a lake basin.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Chlorosis. A yellowing, between the veins on upper foliage, that results from chlorophyll deficiency. Many factors, including heredity, cause chlorosis.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Depth, soil. The depth classes used in this survey are: *very shallow*, 3 to 8 inches of soil over bedrock or other impervious layer that severely restricts growth of plant roots; *shallow*, 8 to 20 inches; *moderately deep*, 20 to 40 inches; and *deep*, more than 40 inches.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized:

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Dryfarming. Production of crops that require some tillage in a subhumid or semiarid region, without irrigation. Usually involves use of periods of fallow, during which time enough moisture accumulates in the soil to allow production of a cultivated crop.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gravel. A mass of rounded or angular fragments up to 3 inches in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the profile and underlying layers, and by height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Loam. The textural class name for a soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Microrelief. Minor surface configurations of the land.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Noncalcareous. As used in this survey, a soil that may or may not be alkaline but that does not contain enough free lime to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Pores, soil. Open channels in the soil material caused by roots and animals, such as earthworms and insects. The terms used to define soil pores are: Amount—*few,* less than 5 per square inch; *common,* 5 to 25 per square inch; and *many,* more than 25 per square inch. Size—*very fine,* less than 0.25 millimeter in diameter; *fine,* 0.25 to 1.0 millimeter; *medium,* 1.0 to 3.0 millimeters; and *coarse,* larger than 3.0 millimeters.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Red bed. Red sedimentary rocks, commonly sandstone and shale, widespread over the Western United States, that range in age from Late Pennsylvanian to Jurassic, but are largely Permian and Jurassic. The coloring of the red beds is ferric anhydride.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residue. Plant material left on or in the soil to improve tilth and to protect against soil blowing and water erosion.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Slope. The incline of the surface of a soil, generally expressed as a percentage; that is, the number of feet of fall per 100 feet of horizontal distance. The slope classes used in this survey are: *nearly level,* 0 to 1 percent; *gently sloping,* 1 to 5 percent; *sloping,* 5 to 8 percent; *strongly sloping,* 8 to 12 percent; *moderately steep,* 12 to 20 percent; and *steep,* 20 to 45 percent.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Soil blowing. The movement of dry soil material by wind.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface layer. The uppermost horizon of a soil; generally the A, A1, or Ap horizon; or the overlying organic layer.

Tableland. Area of land elevated above the general surface of a country.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Underlying material. The C horizon of a soil.

Upland (geology). Land consisting of material unworked by water in recent geological time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the series to which that unit belongs. Dashed lines indicate that the soil was not assigned to an irrigated capability unit. Other information is given as follows:

Acreage and extent, table 1, page 7.
Predicted yields, table 2, page 30.

Engineering uses of the soils, tables 3 and 4, pages 36 through 45.

Map symbol	Mapping unit	Page	Capability unit Dryland	Page	Capability unit Irrigated	Page	Range site	Page
CaA	Capps clay loam, 0 to 1 percent slopes	7	IIIce-2	26	I-2	25	Deep Hardland	31
CaB	Capps clay loam, 1 to 3 percent slopes	7	IIIe-2	27	IIe-1	25	Deep Hardland	31
Cf	Cass fine sandy loam, calcareous	8	Vw-1	29	-----	--	Loamy Bottomland	32
CoA	Conlen loam, 0 to 1 percent slopes	9	IVe-9	28	IIIe-10	28	Hardland Slopes	32
CoB	Conlen loam, 1 to 3 percent slopes	9	IVe-9	28	IIIe-10	28	Hardland Slopes	32
CoC	Conlen loam, 3 to 5 percent slopes	9	IVe-2	28	IVe-6	28	Hardland Slopes	32
CoD	Conlen loam, 5 to 8 percent slopes	9	VIe-1	29	-----	--	Hardland Slopes	32
DaA	Dalhart fine sandy loam, 0 to 1 percent slopes	10	IIIe-4	27	IIe-4	26	Sandy Loam	35
DaB	Dalhart fine sandy loam, 1 to 3 percent slopes	10	IIIe-4	27	IIe-6	26	Sandy Loam	35
DaC	Dalhart fine sandy loam, 3 to 5 percent slopes	10	IVe-4	28	IVe-2	28	Sandy Loam	35
DmA	Dumas loam, 0 to 1 percent slopes	10	IIIce-2	26	I-2	25	Deep Hardland	31
DmB	Dumas loam, 1 to 3 percent slopes	11	IIIe-2	27	IIe-1	25	Deep Hardland	31
DmC	Dumas loam, 3 to 5 percent slopes	11	IVe-1	28	IIIe-2	27	Deep Hardland	31
DtC	Dumas and Tascosa soils, rolling	11	------	--	-----	--	-------	--
	Dumas soil	--	IVe-1	28	-----	--	Deep Hardland	31
	Tascosa soil	--	VIIs-3	29	-----	--	Gravelly	32
EcE	Ector-Ulysses complex, hilly	12	------	--	-----	--	-------	--
	Ector soil	--	VIIs-1	29	-----	--	Very Shallow	35
	Ulysses soil	--	VIIs-1	29	-----	--	Deep Hardland	31
EnD	Enterprise very fine sandy loam, 5 to 8 percent slopes	13	VIe-1	29	-----	--	Mixedland	33
HaA	Harney clay loam, 0 to 1 percent slopes	14	IIIce-2	26	I-1	25	Deep Hardland	31
HaB	Harney clay loam, 1 to 3 percent slopes	14	IIIe-2	27	IIe-2	25	Deep Hardland	31
Hu	Humbarger loam	14	Vw-1	29	-----	--	Loamy Bottomland	32
LkC	Likes loamy fine sand, hummocky	15	VIe-5	29	-----	--	Sandyland	35
LlC	Likes complex, hummocky	15	VIe-5	29	-----	--	Sandyland	35
Ln	Lincoln loamy fine sand	15	Vw-2	29	-----	--	Sandy Bottomland	34
MaB	Manzano clay loam, 1 to 3 percent slopes	16	IIIe-2	27	IIe-1	25	Deep Hardland	31
MrB	Mobeetie fine sandy loam, 1 to 3 percent slopes	17	IIIe-6	27	IIIe-6	27	Mixedland Slopes	33
MrC	Mobeetie fine sandy loam, 3 to 5 percent slopes	17	IVe-5	28	IVe-2	28	Mixedland Slopes	33
MrD	Mobeetie fine sandy loam, 5 to 12 percent slopes	17	VIe-2	29	-----	--	Mixedland Slopes	33
MvC	Mobeetie, Veal, and Pastura soils, rolling	17	-----	--	-----	--	-------	--
	Mobeetie and Veal soils	--	VIe-2	29	-----	--	Mixedland Slopes	33
	Pastura soil	--	VIIs-1	29	-----	--	Very Shallow	35
Nc	Ness clay	18	-----	--	-----	--	-------	--
	Undrained	--	VIw-1	29	-----	--	(1/)	--
	Drained	--	IVs-1	29	IIIs-1	28	(1/)	--
PaE	Pastura complex, hilly	18	VIIs-1	29	-----	--	Very Shallow	35
Ro	Rough broken land	19	VIIs-2	29	-----	--	Rough Breaks	34
ShA	Sherm silty clay loam, 0 to 1 percent slopes	19	IIIce-1	26	IIs-1	26	Deep Hardland	31
ShB	Sherm silty clay loam, 1 to 3 percent slopes	20	IIIe-1	27	IIIe-1	27	Deep Hardland	31
SrD	Springer fine sandy loam, 5 to 8 percent slopes	20	VIe-2	29	-----	--	Sandy Loam	35
SsB	Springer and Likes soils, undulating	20	VIe-5	29	-----	--	Sandyland	35
SuA	Sunray loam, 0 to 1 percent slopes	21	IIIce-3	26	IIe-3	25	Deep Hardland	31
SuB	Sunray loam, 1 to 3 percent slopes	21	IIIe-3	27	IIIe-4	27	Deep Hardland	31
TaE	Tascosa gravelly soils, hilly	21	VIIs-3	29	-----	--	Gravelly	32
TmC	Tascosa, Mobeetie, and Springer soils, rolling	22	-----	--	-----	--	-------	--
	Tascosa soil	--	VIIs-3	29	-----	--	Gravelly	32
	Mobeetie soil	--	VIe-2	29	-----	--	Mixedland Slopes	33
	Springer soil	--	VIe-2	29	-----	--	Sandy Loam	35
TvC	Tivoli fine sand, hummocky	22	VIIe-1	29	-----	--	Deep Sand	31
UsC	Ulysses-Sunray complex, 3 to 5 percent slopes	23	IVe-2	28	IIIe-2	27	Deep Hardland	31
UsD	Ulysses-Sunray complex, 5 to 8 percent slopes	23	VIe-1	29	-----	--	Deep Hardland	31
VeB	Veal fine sandy loam, 1 to 3 percent slopes	23	IVe-10	28	IIIe-10	28	Mixedland Slopes	33
VeD	Veal fine sandy loam, 3 to 8 percent slopes	24	VIe-2	29	-----	--	Mixedland Slopes	33
VnD	Vernon clay loam, 3 to 8 percent slopes	24	VIe-1	29	-----	--	Shallow Redland	35

1/ Ness clay occurs in small areas and is included in the surrounding range sites.

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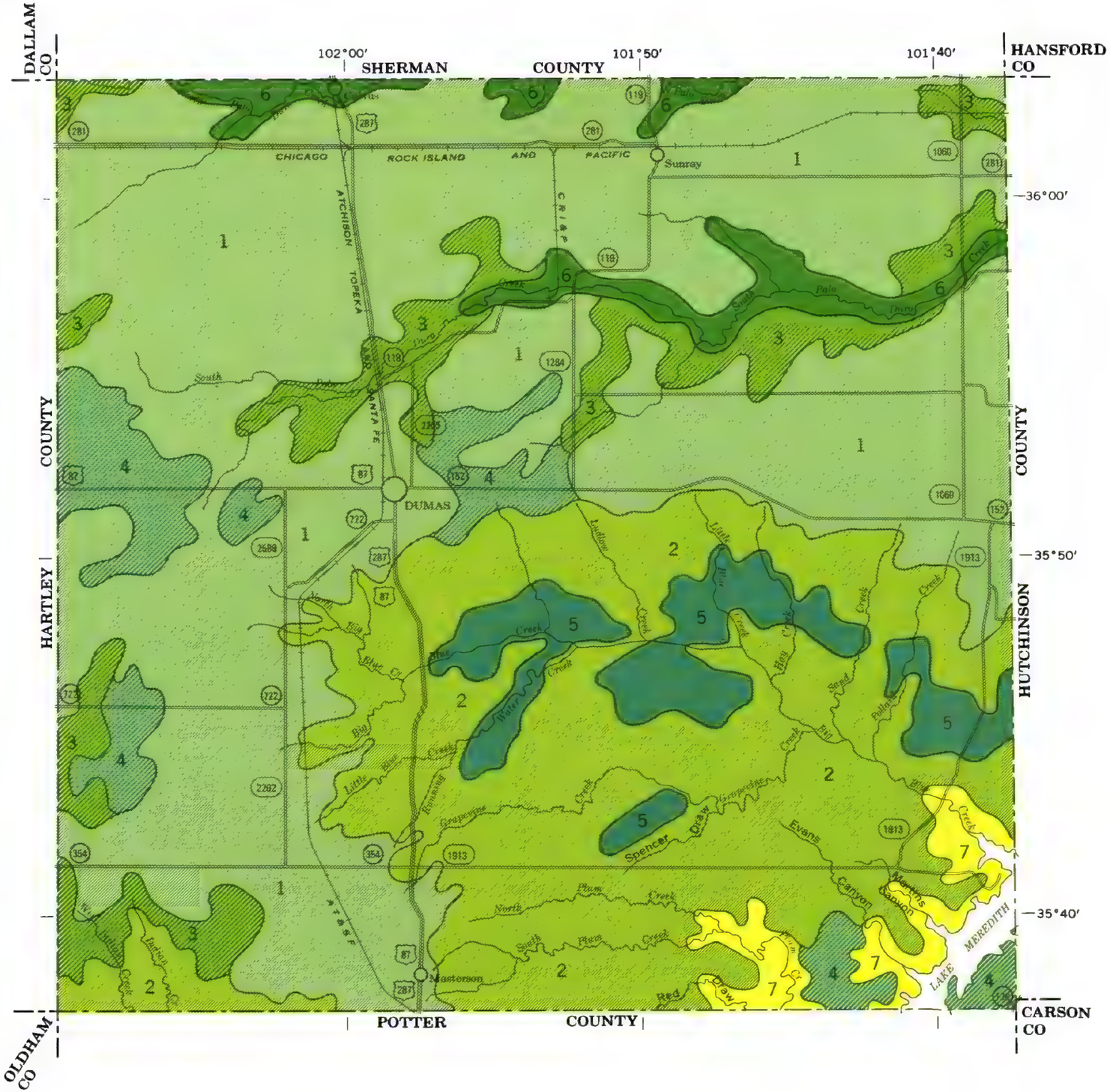

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
MOORE COUNTY, TEXAS

Scale 1:253,440
1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS *

1. Sherm association: Nearly level, deep, noncalcareous, loamy soils
2. Mobeetie-Tascosa-Pastura association: Gently sloping to steep, very shallow to deep, calcareous, loamy and gravelly soils
3. Sunray association: Nearly level to gently sloping, deep, calcareous, loamy soils
4. Dumas-Dalhart association: Nearly level to gently sloping, deep, noncalcareous, loamy soils
5. Likes-Springer-Tivoli association: Undulating to hummocky and duned, deep, calcareous and noncalcareous, sandy soils
6. Sunray-Ulysses-Humbarger association: Nearly level to sloping, deep, calcareous, loamy soils
7. Rough broken land association: Escarpments, gullies, canyon walls, and sloping to very steep areas

* Texture refers to the surface layer of the major soils in each association.

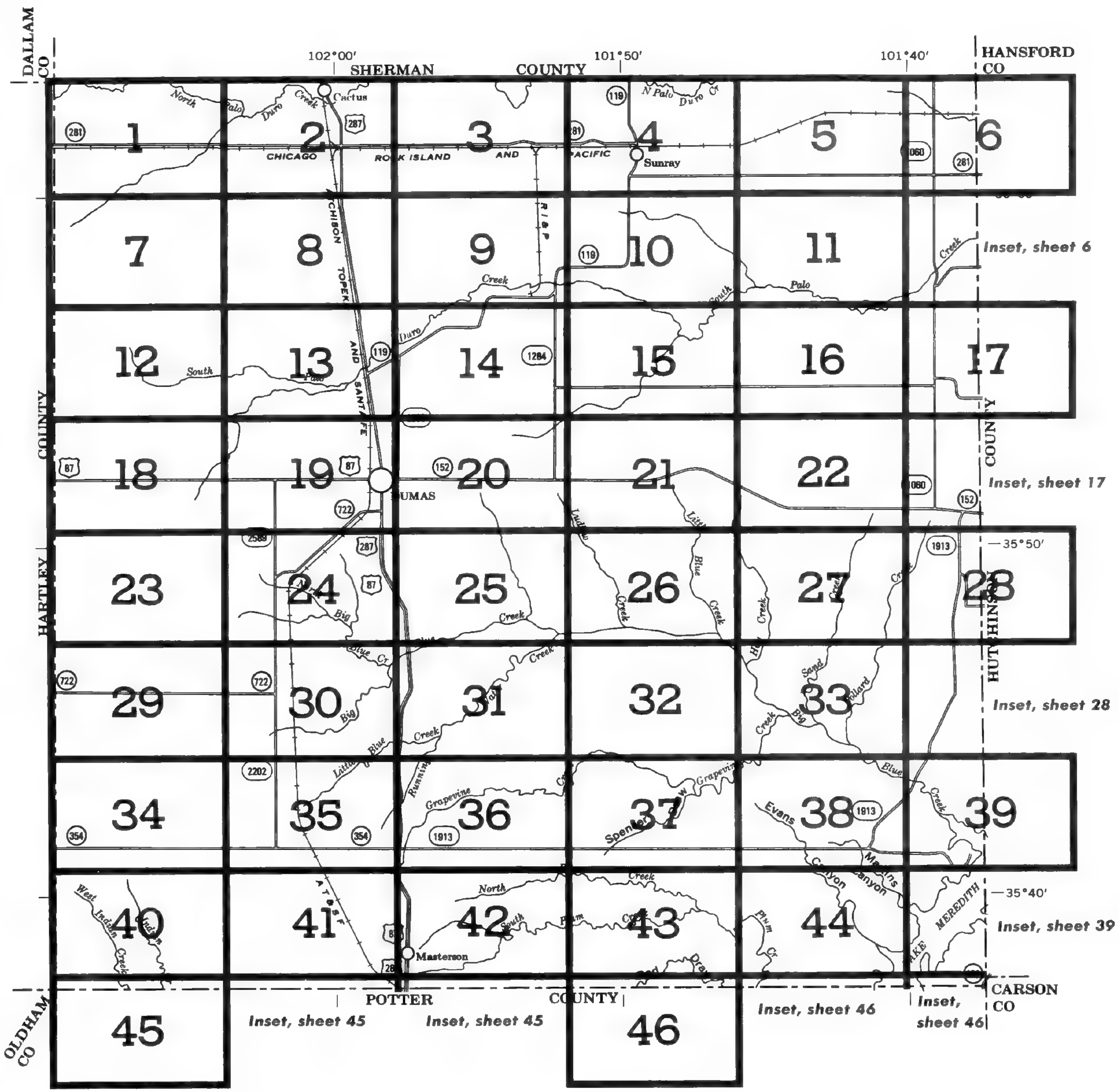
Compiled 1972

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS
MOORE COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope.

SYMBOL	NAME
CaA	Capps clay loam, 0 to 1 percent slopes
CaB	Capps clay loam, 1 to 3 percent slopes
Cf	Cass fine sandy loam, calcareous
CoA	Conlen loam, 0 to 1 percent slopes
CoB	Conlen loam, 1 to 3 percent slopes
CoC	Conlen loam, 3 to 5 percent slopes
CoD	Conlen loam, 5 to 8 percent slopes
DaA	Dalhart fine sandy loam, 0 to 1 percent slopes
DaB	Dalhart fine sandy loam, 1 to 3 percent slopes
DaC	Dalhart fine sandy loam, 3 to 5 percent slopes
DmA	Dumas loam, 0 to 1 percent slopes
DmB	Dumas loam, 1 to 3 percent slopes
DmC	Dumas loam, 3 to 5 percent slopes
DtC	Dumas and Tascosa soils, rolling
EcE	Ector-Ulysses complex, hilly
EnD	Enterprise very fine sandy loam, 5 to 8 percent slopes
HaA	Harney clay loam, 0 to 1 percent slopes
HaB	Harney clay loam, 1 to 3 percent slopes
Hu	Humbarger loam
LkC	Likes loamy fine sand, hummocky
LlC	Likes complex, hummocky
Ln	Lincoln loamy fine sand
MaB	Manzano clay loam, 1 to 3 percent slopes
MrB	Mobeetie fine sandy loam, 1 to 3 percent slopes
MrC	Mobeetie fine sandy loam, 3 to 5 percent slopes
MrD	Mobeetie fine sandy loam, 5 to 12 percent slopes
MvC	Mobeetie, Veal, and Pastura soils, rolling
Nc	Ness clay
PaE	Pastura complex, hilly
Ro	Rough broken land
ShA	Sherm silty clay loam, 0 to 1 percent slopes
ShB	Sherm silty clay loam, 1 to 3 percent slopes
SrD	Springer fine sandy loam, 5 to 8 percent slopes
SsB	Springer and Likes soils, undulating
SuA	Sunray loam, 0 to 1 percent slopes
SuB	Sunray loam, 1 to 3 percent slopes
TaE	Tascosa gravelly soils, hilly
TmC	Tascosa, Mobeetie, and Springer soils, rolling
TvC	Tivoli fine sand, hummocky
UsC	Ulysses-Sunray complex, 3 to 5 percent slopes
UsD	Ulysses-Sunray complex, 5 to 8 percent slopes
VeB	Veal fine sandy loam, 1 to 3 percent slopes
VeD	Veal fine sandy loam, 3 to 8 percent slopes
VnD	Vernon clay loam, 3 to 8 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church
- Mine and quarry
- Gravel pit, caliche pit
- Power line
- Pipeline
- Cemetery
- Dams
- Levee
- Tanks
- Well, oil or gas
- Forest fire or lookout station
- Windmill
- Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified
- Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)
- Spring
- Well, irrigation
- Flood pool line
- Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other
- Short steep slope
- Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Fence

MOORE COUNTY, TEXAS — SHEET NUMBER 1

1 810 000 FEET

SHERMAN COUNTY

HARTLEY COUNTY

CHICAGO AND PACIFIC

740 000 FEET

730 000 FEET

1 830 000 FEET

(Joins sheet 2)

(Joins sheet 7)

N

Scale 1:24 000

2 Miles

10 000 Feet

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approximately positioned on this map.

SHERMAN COUNTY

1 860 000 FEET

N

2 Miles 10 000 Feet

1 5 000

Scale 1:24 000

C 0 1 000 2 000 3 000 4 000 5 000 FEET

¼ ½ ¾ 1

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 8)

730 000 FEET

1 840 000 FEET

740 000 FEET

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Land divis on corners are approximately positioned on this map.

1 870 000 FEET

SHERMAN COUNTY

740 000 FEET

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 9)

1 890 000 FEET

730 000 FEET

Bryden

Sheerin Junction

North Palo Duro Creek

CHICAGO ROCK ISLAND AND PACIFIC

Scale 1:24 000

2 Miles

10 000 Feet

N

MOORE COUNTY, TEXAS — SHEET NUMBER 4

SHERMAN COUNTY

1 920 000 FEET

N

2 Miles

10 000 Feet

Scale 1:24 000

5 000

0

1 000

2 000

3 000

4 000

5 000

730 000 FEET

740 000 FEET

1 900 000 FEET

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 10)

93 94 95 96 97 98

118 117 116 115 114 113

121 122 123 124

143 142 141 140 139

North Palo Duro Creek

CHICAGO ROCK ISLAND PACIFIC

ROCK ISLAND PACIFIC

CHICAGO

281 119

ShA ShB Nc CoB CaB CoD CaA CoA SuA SuB PaE UsC UsD MrC MrD MaB Hu

Land divisions on corners are approximately positioned on this map

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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MOORE COUNTY, TEXAS — SHEET NUMBER 5

SHERMAN COUNTY

1 930 000 FEET

(Joins sheet 4)

1 740 000 FEET

(Joins sheet 6)

1 730 000 FEET

(Joins sheet 11)

1 950 000 FEET

99 100 101 102 103 104

112 111 110 109 108 107

125 126 127 128 129 130

138 137 136 135 134 133

ROCK ISLAND AND PACIFIC

CHICAGO

281

SuB ShB CoB MrC PaE SuA HaA UsC HaB Nc ShA CaB CaA

5

N

2 Miles

10 000 Feet

1

5 000

Scale 1:24 000

0 1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

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Land division corners are approximately positioned on this map.

MOORE COUNTY, TEXAS — SHEET NUMBER 6

N

Scale 1:24 000

2 Miles 1 0 10 000 Feet

5 000 0 5 000

¼ 1 000 0 ¼ 2 000

½ 3 000 ½ 4 000

¾ 4 000 ¾ 5 000

1 5 000 1

SHERMAN COUNTY

1 960 000 FEET

HUTCHINSON COUNTY

740 000 FEET

730 000 FEET

1 955 000 FEET

(Joins upper right)

(Joins sheet 5)

(Joins lower left)

720 000 FEET

(Joins sheet 11)

710 000 FEET

1 955 000 FEET

(Joins sheet 17)

5,000 AND 10,000-FOOT GRID TICKS

Capps Switch

CHICAGO ROCK ISLAND AND PACIFIC

Creek

Dump

Palo

South

Land division corners are approximately positioned on this map

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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MOORE COUNTY, TEXAS — SHEET NUMBER 7

(Joins sheet 1)

1 810 000 FEET

720 000 FEET

HARTLEY COUNTY

425 426 427 428 429 430

416 415 414 413 412 411

383 384 385 386 387 388

374 373 372 371 370 369

ShA ShB SuA SuB CoB CaA HaA Nc DmA

(Joins sheet 8)

(Joins sheet 12)

1 830 000 FEET

710 000 FEET

N

2 Miles 10 000 Feet

Scale 1:24 000

1 5 000 0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000

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Land division corners are approximately positioned on this map.

MOORE COUNTY, TEXAS — SHEET NUMBER 8

(Joins sheet 2)

1 860 000 FEET

N

2 Miles

10 000 Feet

1

5 000

0

Scale 1:24 000

0

1 000

¼

2 000

½

3 000

¾

4 000

1

5 000

(Joins sheet 7)

710 000 FEET

(Joins sheet 13)

1 840 000 FEET

720 000 FEET

(Joins sheet 9)

ATCHISON TOPEKA

SANTA FE

287

Land divis on corners are approximately positioned on this map

Photobase from 1971 aerial photography. Positions of 10,000-foot grid :icks are approximate and based on the Texas coordinate system, north zone

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MOORE COUNTY, TEXAS — SHEET NUMBER 9

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Texas Agricultural Experiment Station
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approximately positioned on this map.

1 870 000 FEET

(Joins sheet 3)

720 000 FEET

(Joins sheet 8)

710 000 FEET

(Joins sheet 10)

(Joins sheet 14)

1 890 000 FEET

436 437 438 439 440 441

405 404 403 402 401 400

394 395 396 397 398 399

363 362 361 360 359 358

PACIFIC

CHICAGO, ROCK ISLAND AND

CARBON BLACK

Sherrin

Electric Power Plant

Chemical Fertilizer Plant

INDUSTRIAL AREA

Palo Duro Creek

South

119 721 1224

ShA ShB SuA SuB CoA CoB CoC CoD DaA DaB DmA DmB HaA HaB Hu Nc PaE SE UsC UsD VeD

9

N

2 Miles 1

10 000 Feet 5 000

Scale 1:24 000

0 1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

N

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

(Joins sheet 4)

1 920 000 FEET

(Joins sheet 9)

710 000 FEET

(Joins sheet 15)

1 900 000 FEET

(Joins sheet 11)

720 000 FEET

142 144 146 147 148

167 166 165 164 163

168 169 170 171 172

191 190 189 188 187

25 25

ShA ShB SuA SuB UsC UsD CoB CoD CoC DmA DmB HaB PaE

Natural Gas Compression Plant

Electric Power Plant

Gasoline Plant

Compression Plant

South Palo Duro Creek

C R I AND P

Land division corners are approximately positioned on the map.

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Land division corners are approximately positioned on this map.

(Joins sheet 10)

1 930 000 FEET

1 720 000 FEET

(Joins sheet 5)

(Joins inset, sheet 6)

(Joins sheet 16)

1 950 000 FEET

710 000 FEET

11

N

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

5 000 4 000 3 000 2 000 1 000 0

(Joins sheet 7)

1 830 000 FEET

N

2 Miles

10 000 Feet

1

5 000

Scale 1:24 000

0

0

¼

1 000

½

2 000

¾

3 000

1

4 000

5 000

HARTLEY COUNTY

341 342 343 344 345 346

332 331 330 329 328 327

299 300 301 302 303 304

289 288 287

ShA SuA DmA HaA SuB ShB DmB Nc Hu CoB DaB DaA HaB

Dixie Creek

South Palo Duro

690 000 FEET

(Joins sheet 18)

1 810 000 FEET

(Joins sheet 13)

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000 foot grid ticks are approximate and based on the Texas coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Texas Agricultura Experiment Station.

MOORE COUNTY, TEXAS — SHEET NUMBER 13

13

N

(Joins sheet 8)

1 840 000 FEET

Machovec

347 348 349 350 351

326 325 324 323 322

305 306 307 308 309

South Palo Duro Creek

ATCHISON TOPEKA SANTA FE

(Joins sheet 12)

700 000 FEET

(Joins sheet 14)

690 000 FEET

(Joins sheet 19)

1 860 000 FEET

2 Miles

10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1 5 000

Scale 1:24 000

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Land division corners are approximately positioned on this map.

(Joins sheet 9)

1 890 000 FEET

(Joins sheet 13)

(Joins sheet 15)

1 700 000 FEET

(Joins sheet 20)

1 870 000 FEET

690 000 FEET

N

Scale 1:24 000

2 Miles 10 000 Feet

1 5000 0 1 000 2000 3000 4000 5000

¼ ½ ¾ 1

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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MOORE COUNTY, TEXAS — SHEET NUMBER 15

15

N

2 Miles
10 000 Feet
1
5 000

Scale 1:24 000

0 1 000 2 000 3 000 4 000 5 000
0 ¼ ½ ¾ 1

(Joins sheet 11)

1 950 000 FEET

N

2 Miles

10 000 Feet

1

5 000

Scale 1:24 000

0 0 1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

690 000 FEET

(Joins sheet 15)

(Joins sheet 22)

1 930 000 FEET

700 000 FEET

(Joins sheet 17)

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

1 955 000 FEET (Joins inset, sheet 6)

700 000 FEET (Joins sheet 16)

690 000 FEET

1 960 000 FEET (Joins upper right)

5,000 AND 10,000-FOOT GRID TICKS

1 955 000 FEET (Joins lower left)

680 000 FEET (Joins sheet 22)

670 000 FEET

1 960 000 FEET (Joins sheet 28)

5,000 AND 10,000-FOOT GRID TICKS

17

N

2 Miles

10 000 Feet

Scale 1:24 000

(Joins sheet 12)

1 830 000 FEET

690 000 FEET

(Joins sheet 19)

1 680 000 FEET

HARTLEY COUNTY

1 810 000 FEET

(Joins sheet 23)

N

Scale 1:24 000

2 Miles 10 000 Feet

1 5 000

0 0

¼ 1 000 2 000

½ 3 000

¾ 4 000

1 5 000

Land division corners are approximately positioned on this map

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approximately positioned on this map.

1 840 000 FEET

690 000 FEET

(Joins sheet 18)

(Joins sheet 13)

(Joins sheet 20)

(Joins sheet 24)

1 860 000 FEET

680 000 FEET

284 283 282 281 280

263 264 265 267

242 240 239 238

221 222 223 224 225

ShA SuA CaA HaA DmA DmB DaA DaB SuB CoA Nc HuA ShB SuA CoC CaB MrD UsC

DUMAS MUNICIPAL AIRPORT

DUMAS (county seat)

Hospital

Court House

SANTA FE

TOPEKA

ATCHISON

87 152 287 722

19

N

2 Miles 10 000 Feet

1 5 000

Scale 1:24 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

(20)

(Joins sheet 14)

1 890 000 FEET

690 000 FEET

N

2 Miles

10 000 Feet

1

5 000

0

Scale 1:24 000

1 680 000 FEET

(Joins sheet 19)

279 278 277 276 275 274

268 269 270 271 272 273

237 236 235 234 233 232

226 227 228 229 230 231

DUMAS
(county seat)

Bone Lake

SEWAGE DISPOSAL

1 870 000 FEET

(Joins sheet 25)

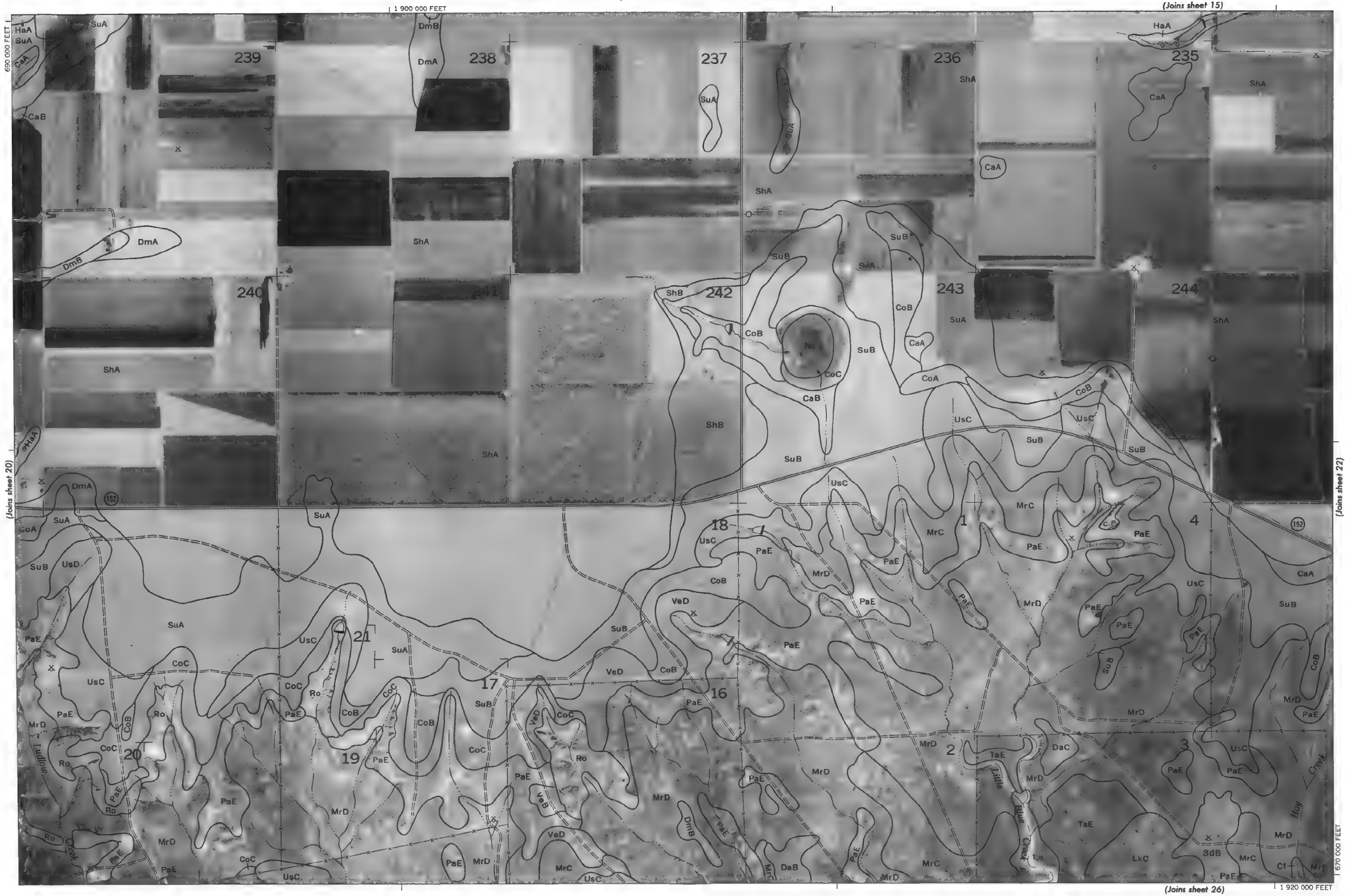
(Joins sheet 21)

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Texas Agricultural Experiment Station.

MOORE COUNTY, TEXAS — SHEET NUMBER 21



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Land division corners are approximately positioned on this map.

N

Scale 1:24 000

2 Miles 1 0 1 2 3 4 5

10 000 Feet 5 000 0 5 000 10 000 15 000 20 000

(Joins sheet 16)

1 950 000 FEET

234 233 232 231 230 229

245 246 247 248 249 250

6 7 57 58 59 60

5 8 5 6 7 8

ShB ShA Nc CoD CoB SuA SuB CaA MrD Ro PaE CoC CoD UsC UsD HaA DmA DmB CoA ShB

152

Hay Creek

Sand Creek

(Joins sheet 21)

670 000 FEET

(Joins sheet 27)

1 930 000 FEET

(Joins inset, sheet 17)

1 680 000 FEET

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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MOORE COUNTY, TEXAS — SHEET NUMBER 23

1 810 000 FEET

(Joins sheet 18)

670 000 FEET

HARTLEY COUNTY

Grain Elevator

(Joins sheet 24)

1 660 000 FEET

(Joins sheet 29)

1 830 000 FEET

23

N

Scale 1:24 000

2 Miles

10 000 Feet

5 000

0

1 000

2 000

3 000

4 000

5 000

1

¼

½

¾

1

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Texas Agriculture Experiment Station.
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MOORE COUNTY, TEXAS — SHEET NUMBER 24

(24)

N

Scale 1:24 000

2 Miles 1 0 10 000 Feet

1 5 000 0 1 000 2 000 3 000 4 000 5 000 FEET

660 000 FEET

1 860 000 FEET

670 000 FEET

(Joins sheet 23)

(Joins sheet 30)

1 840 000 FEET

(Joins sheet 25)

Land division corners are approximately positioned on this map.

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Photobase from 1971 aerial photography. Positions of 10 000-foot grid ticks are approximate and based on the Texas coordinate system, north zone
Land division corners are approximately positioned on this map

1 870 000 FEET

(Joins sheet 20)

670 000 FEET

(Joins sheet 24)

660 000 FEET

(Joins sheet 26)

(Joins sheet 31)

1 890 000 FEET

25

N

Scale 1:24 000

2 Miles 10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1¼ 5 000

(26)

N

(Joins sheet 21)

1 920 000 FEET

670 000 FEET

660 000 FEET

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 32)

1 900 000 FEET

Scale 1:24 000

2 Miles 0 10 000 Feet

1 5 000 0

¾ 4 000 3 000

½ 2 000 1 000

¼ 0

1 5 000 0

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approximately positioned on this map.

(Joins sheet 26)

1 930 000 FEET

670 000 FEET

(Joins sheet 22)

Booster Station

Creek

Sand Creek

Pollard Creek

Hu

(Joins sheet 33)

1 950 000 FEET

660 000 FEET

(Joins sheet 28)

27

N

2 Miles

10 000 Feet

Scale 1:24 000

1 5 000 0 1 000 2 000 3 000 4 000 5 000

28

N

Scale 1:24 000

2 Miles 1 0 10 000 Feet

1 5 000 0

¾ 4 000 ½ 3 000 ¼ 2 000 0 1 000 0

(Joins inset, sheet 17)

1 960 000 FEET

670 000 FEET

(Joins sheet 27)

660 000 FEET

1 955 000 FEET

5,000 AND 10,000-FOOT GRID TICKS

(Joins upper right)

(Joins lower left)

1 960 000 FEET

650 000 FEET

640 000 FEET

(Joins sheet 33)

1 955 000 FEET

5,000 AND 10,000-FOOT GRID TICKS

(Joins sheet 39)

HUTCHINSON COUNTY

SNEED CAMP

Gasoline Plant

Natural Gas Compressor Plant

Armstrong School

1913

ShA SuB UsC CoC CaA DmB CoB UsD PaE MvC SuA HaA ShB HaB VeD DaC DaB TvC SsB LkC MrC MrB LIC Ln Cf TaE Ro

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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1 810 000 FEET

(Joins sheet 23)

1 650 000 FEET

COUNTY

(Joins sheet 30)

1 640 000 FEET

(Joins sheet 34)

1 830 000 FEET

29

N

Scale 1:24 000

2 Miles

10 000 Feet

5 000

MOORE COUNTY, TEXAS — SHEET NUMBER 30

(30)

N

(Joins sheet 24)

(Joins sheet 29)

(Joins sheet 31)

(Joins sheet 35)

1 860 000 FEET

1 840 000 FEET

640 000 FEET

650 000 FEET

Scale 1:24 000

2 Miles 10 000 Feet 5 000 0

1 ¼ ½ ¾ 1

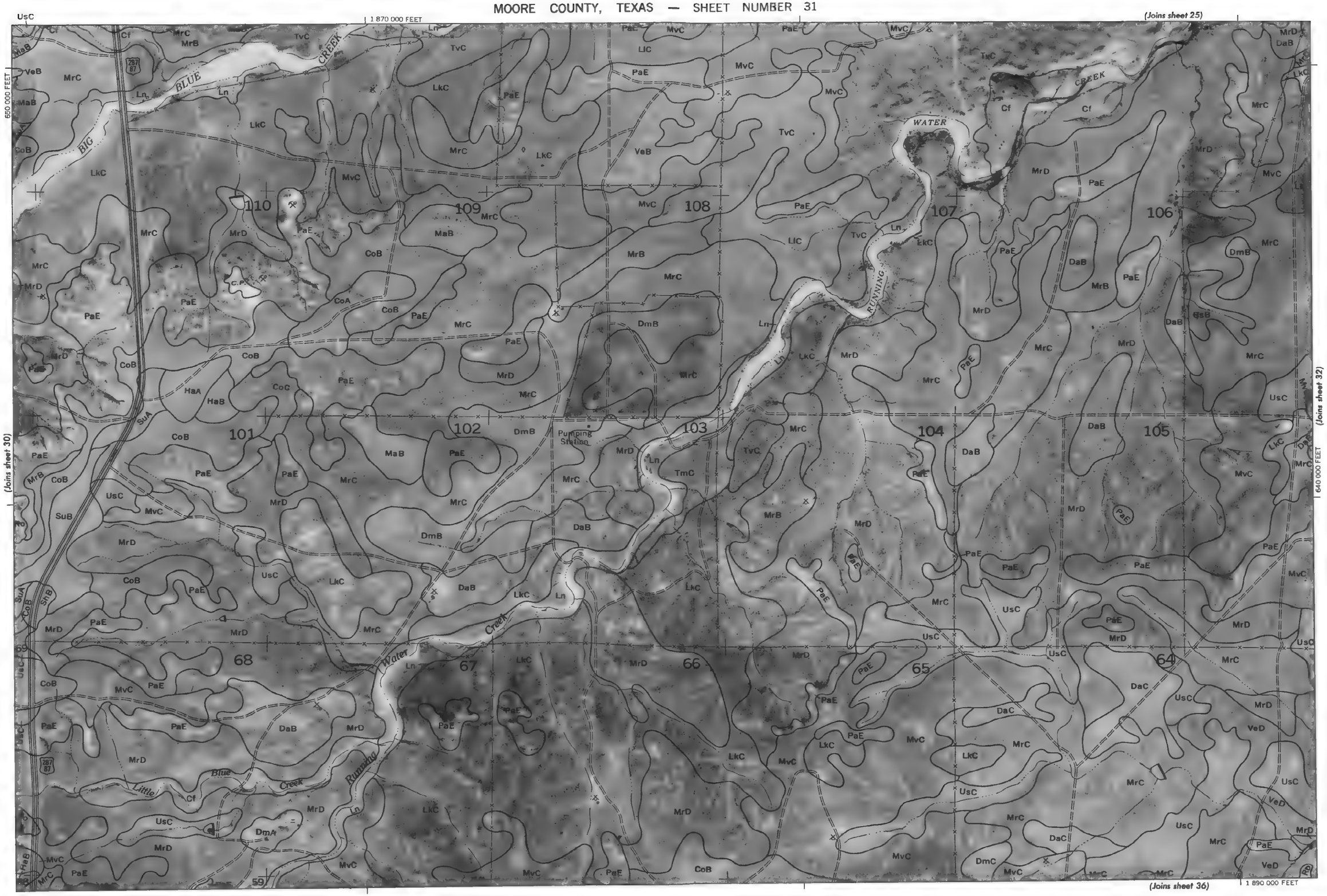
5 000 4 000 3 000 2 000 1 000 0

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coord nate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Texas Agricultural Experiment Station.

MOORE COUNTY, TEXAS — SHEET NUMBER 31



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Land division corners are approximately positioned on this map.

(31)

N

2 Miles
10 000 Feet
1
5 000
Scale 1:24 000
0
0
¼
1 000
½
2 000
¾
3 000
1
4 000
5 000

MOORE COUNTY, TEXAS — SHEET NUMBER 32

N

2 Miles

10 000 Feet

Scale 1:24 000

1 920 000 FEET

650 000 FEET

640 000 FEET

1 900 000 FEET

(Joins sheet 26)

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 37)

BIG BLUE CREEK

Compression Station

Gruber Ln

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Texas Agricultural Experiment Station.

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approximately positioned on this map.

1 930 000 FEET

650 000 FEET

(Joins sheet 32)

(Joins sheet 27)

(Joins inset, sheet 28)

640 000 FEET

(Joins sheet 38)

1 950 000 FEET

33

N

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

1 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

BIG BLUE CREEK

Compression Station

Booster Station

Compression Plant

Grapevine Creek

Gary Draw

NATIONAL PARK BDY.

(Joins sheet 29)

1 830 000 FEET

630 000 FEET

620 000 FEET

1 810 000 FEET

(Joins sheet 35)

(Joins sheet 40)

HARTLEY COUNTY

N

Scale 1:24 000

2 Miles — 10 000 Feet

1 — 5 000

0 — 0

¼ — 1 000

½ — 2 000

¾ — 3 000

1 — 4 000

1 — 5 000

Land division corners are approximately positioned on this map

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approx mately positioned on this map.

1 840 000 FEET

1 630 000 FEET

(Joins sheet 30)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 41)

1 860 000 FEET

620 000 FEET

35

N

Scale 1:24 000

2 Miles

10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1 5 000

Bautista

Four Way

ATCHISON TOPEKA AND SANTA FE

Blue Creek

Little Sand Creek

Running Water Creek

53 54 55 56 57 58

32 31 30 29 28 27

11 12 13 14 15 16

10 11 19 20 29 30

ShA SuA ShB SuB SuC UsC UsD CoC CoB MrC MrD MvC PaE HaA HaB DmB DmC Nc Ro

N

Scale 1:24 000

2 Miles 1 0 10 000 Feet 5 000 0

1 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

1 620 000 FEET

1 890 000 FEET

630 000 FEET

1 870 000 FEET

(Joins sheet 31)

(Joins sheet 35)

(Joins sheet 37)

(Joins sheet 42)

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Texas Agricultural Experiment Station.

MOORE COUNTY, TEXAS — SHEET NUMBER 37

1 900 000 FEET

630 000 FEET

(Joins sheet 32)

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 43)

1 920 000 FEET

620 000 FEET

37

N

2 Miles

10 000 Feet

5 000

0

Scale 1:24 000

1 0 1 000 2 000 3 000 4 000 5 000

Creek

Grapevine

Spencer Draw

Compression Plant

Natural Gas Plant

Natural Gas Compression Plant

Television Relay Tower

ZOFNESS CAMP (ABANDONED)

38

N

(Joins sheet 33)

1 950 000 FEET

630 000 FEET

(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 44)

1 930 000 FEET

2 Miles

10 000 Feet

Scale 1:24 000

620 000 FEET

1 | 5 000 | 0 | 0

¼ | 1 000 | 2 000

½ | 3 000 | 4 000

¾ | 5 000

1

Land division corners are approximately positioned on this map

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approximately positioned on this map

1 955 000 FEET

(Joins inset, sheet 28)

630 000 FEET

(Joins sheet 38)

610 000 FEET

(Joins lower left)

(Joins sheet 44)

620 000 FEET

600 000 FEET

(Joins upper right)

(Joins inset B, sheet 46)

1 960 000 FEET

5,000 AND 10,000-FOOT GRID TICKS

N

2 Miles

10 000 Feet

5 000

Scale 1:24 000

0 1 000 2 000 3 000 4 000 5 000

MOORE COUNTY, TEXAS — SHEET NUMBER 40

(Joins sheet 34)

1 830 000 FEET

610 000 FEET

N

2 Miles

10 000 Feet

Scale 1:24 000

600 000 FEET

1 810 000 FEET

(Joins sheet 45)

(Joins sheet 41)

COUNTY

HARTLEY

West Indian Creek

Indian Creek

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approximately positioned on this map.

1 840 000 FEET

610 000 FEET

(Joins sheet 35)

(Joins sheet 40)

(Joins sheet 42)

(Joins inset A, sheet 45)

1 860 000 FEET

600 000 FEET

41

N

Scale 1:24 000

2 Miles 1 0

10 000 Feet 5 000 0

1 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

8 12 18 21 28 7 13 17 22 27 14 15 16 23 26 85 24 25

SuA SuB ShA ShB HaB HaA Nc CoB CoC CoD UsC UsD PaE Ro

ATCHISON SANTA FE

Creek

Sand

Exell

Helium Plant

N

2 Miles 10 000 Feet

1 5 000

Scale 1:24 000

1 0 1

¼ 0 ¼

½ 1 000 2 000 ½

¾ 3 000 4 000 ¾

1 5 000 0 1

600 000 FEET

1 890 000 FEET

1 870 000 FEET

1 610 000 FEET

(Joins sheet 36)

(Joins sheet 41)

(Joins sheet 43)

(Joins inset B, sheet 45)

Land division corners are approximate y pos.tioned on this map

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approximately positioned on this map.

N

610 000 FEET

1 900 000 FEET

(Joins sheet 37)

(Joins sheet 42)

(Joins sheet 44)

(Joins sheet 46)

1 920 000 FEET

600 000 FEET

Natural Gas Compression Plant

North Plum Creek

South Plum Creek

Plum Creek

Pumping Station

Pumping Station

SOUTH CAMP

Scale 1:24 000

2 Miles

10 000 Feet

(Joins sheet 38)

1 950 000 FEET

610 000 FEET

(Joins sheet 43)

600 000 FEET

(Joins inset, sheet 39)

(Joins inset A, sheet 46)

1 930 000 FEET

N

2 Miles

10 000 Feet

Scale 1:24 000

1 5 000

0 1 000 2 000 3 000 4 000 5 000

1/4 1/2 3/4

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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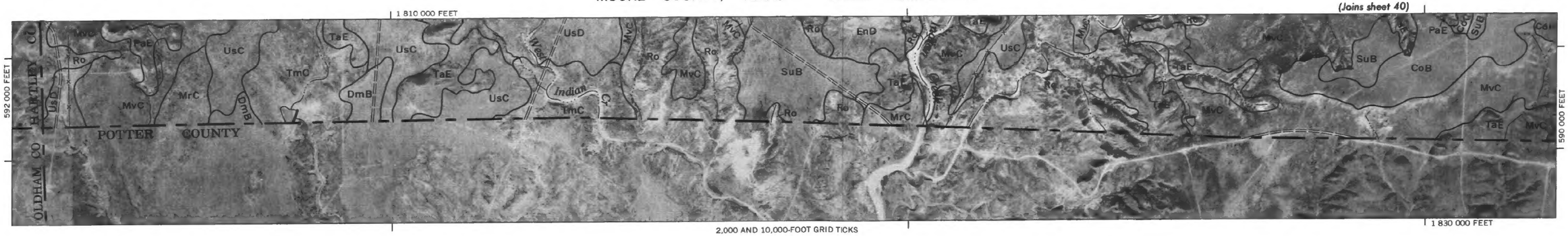
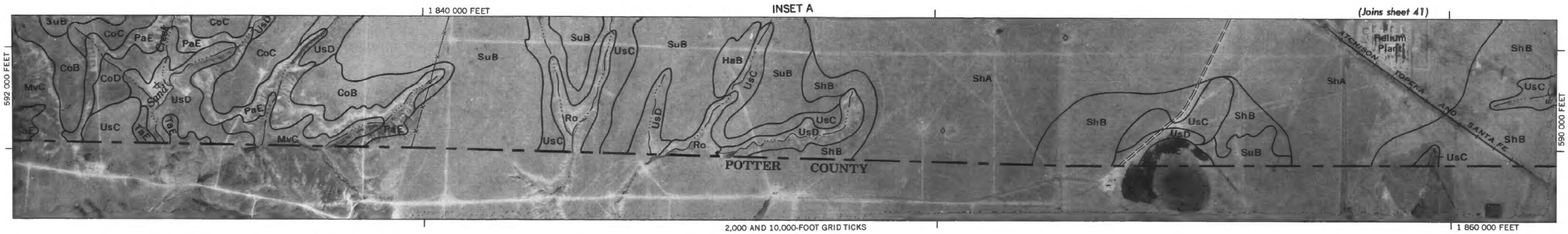
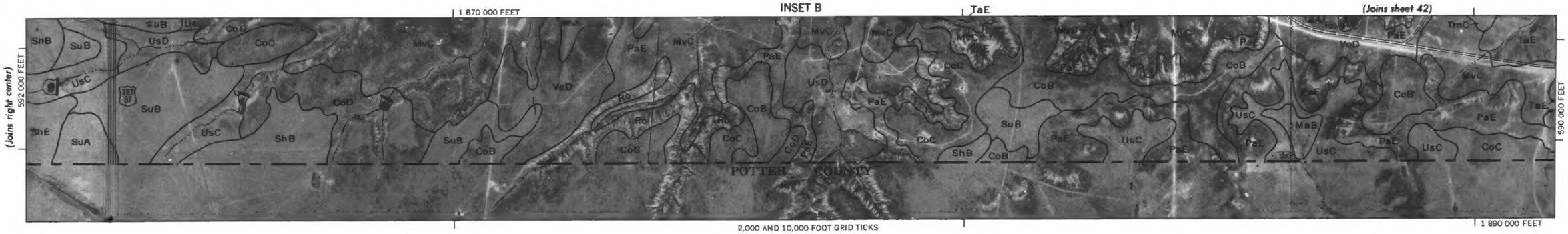
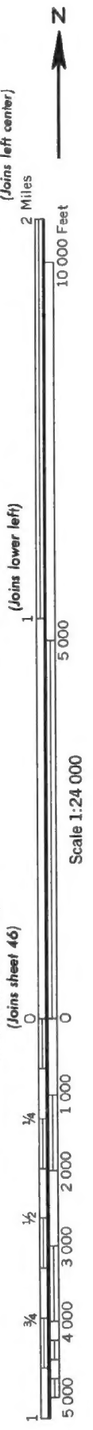
MOORE COUNTY, TEXAS — SHEET NUMBER 45









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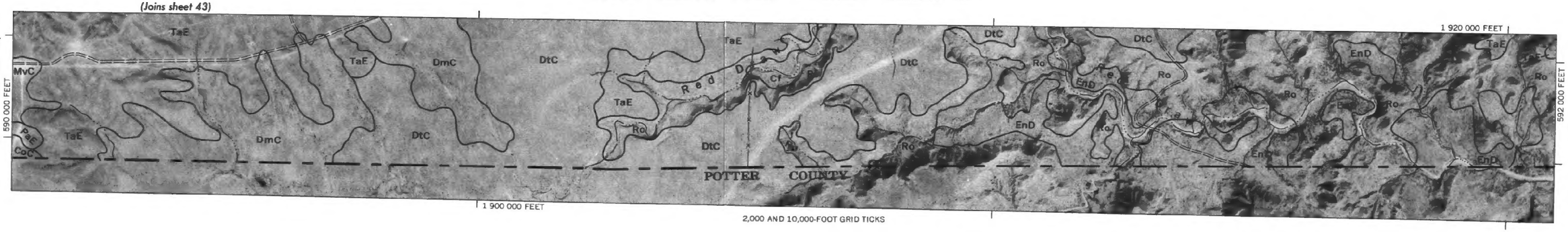
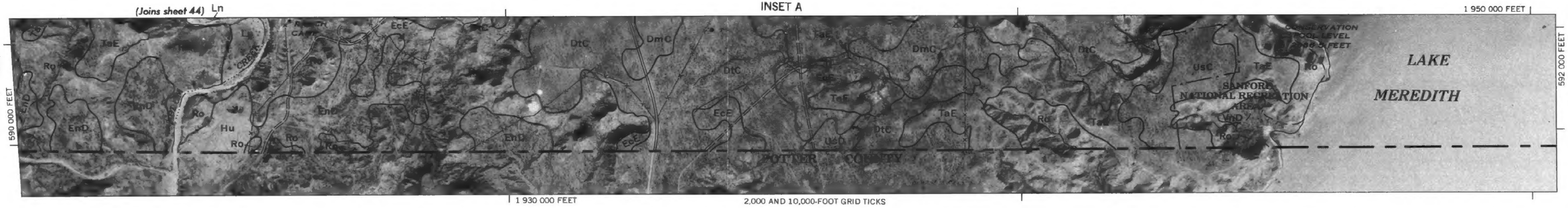
Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.
Land division corners are approximately positioned on this map.

MOORE COUNTY, TEXAS — SHEET NUMBER 46



INSET A



INSET B

N

Scale 1:24 000

2 Miles 1 0 10 000 Feet

5 000 0 5 000

¼ 0 1 000

½ 1 2 000 3 000

¾ 4 000

1 5 000

Land division corners are approximate and based on the Texas coordinate system, north zone.

Photobase from 1971 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north zone.

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